



INDIA
NATION ACTION PROGRAMME TO COMBAT DESERTIFICATION

In the Context of
UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION
(UNCCD)

Volume-I
Status of Desertification

MINISTRY OF ENVIRONMENT & FORESTS
GOVERNMENT OF INDIA
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FOREWORD

India is endowed with a wide variety of climate, ecological regions, land and water resources. However, with barely 2.4% of the total land area of the world, our country has to support 16.7% of the total human population and about 18% of the total livestock population of the world. This has put enormous pressure on our natural resources. Ecosystems are highly complex systems relating to a number of factors -both biotic and abiotic - governing them. Natural ecosystems by and large have a high resilience for stability and regeneration. However, continued interference and relentless pressures on utilisation of resources leads to an upset of this balance. If these issues are not effectively and adequately addressed in a holistic manner, they can lead to major environmental problems such as depletion of vegetative cover, increase in soil erosion, decline in water table, and loss of biodiversity all of which directly impact our very survival. Thus, measures for conservation of soil and other natural resources, watershed development and efficient water management are the key to sustainable development of the country. The socio-economic aspects of human activities form an important dimension to the issue of conservation and protection of natural resources. The measures should not only include rehabilitation of degraded lands but to also ensure that the living conditions of the local communities are improved.

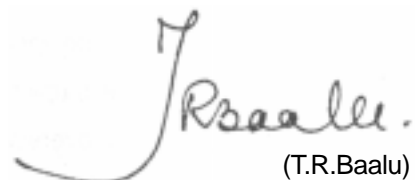
The Government of India has created the enabling constitutional, legal, policy and programme framework for addressing these issues right from the inception of the First Five-year Plan. Over the last decade or so, a large number of new initiatives were taken to strengthen the policy and programmes in the relevant sectors which include agriculture, environment and forests, rural development, social welfare, poverty alleviation and women's upliftment and empowerment. These include initiatives for addressing food production, preventing and reversing land degradation as also the associated issues of human development, which are inextricably interlinked with sustainable development of the country.

A major part of the country's geographical area is in the 'drylands'. While our country has been endowed with plentiful rainfall, it is for a small period and in high intensity. Water being central to existence of life, the

importance of water for sustenance of life is becoming increasingly realised across the country. Water scarcity is a major problem both in urban and rural areas. Unless intense activities for its collection, storage, conservation, and regeneration are taken in tandem, it can lead to major environmental and socio-economic problems in the coming decades. Recognising the importance the Government has adopted Integrated Watershed Programme incorporating these components in various programmes using the watershed as an ecological unit. The 'Common Approach to Watershed Programmes of the country', is being implemented through the relevant Ministries of Agriculture, Rural Development, Environment and Forests and other relevant institutions.

The Government also took the necessary steps to amend the Constitution of India to provide the necessary base for decentralised governance involving the local communities. The Watershed Programme of the country has been based central to this concept. The Government has prepared long-term perspective plans, which envisage continued process of decentralisation and further integration of the various schemes and programmes using the watershed approach. The Ministry of Environment and Forests has also prepared a long-term perspective plan for the afforestation of the forest land in the country in a sustainable manner through the National Forestry Action Programme. Thus, combating desertification is an important aspect of our national plans and priorities. However, despite our on-going and future efforts, it is expected that there would be large gaps between what is achieved and what is yet to be addressed in the context of sustainable development. Financial constraint is a major impeding factor in achieving the desired objectives and goals.

The United Nations Convention to Combat Desertification is an important Convention which focuses on these issues in a global dimension involving national and international communities. The Convention also recognises the urgent need to facilitate the implementation of national plans and priorities through effective international co-operation. The India-National Action Programme for combating desertification has been prepared in the context of the UNCCD, for all the relevant stakeholders, both at national and international level, to take appropriate action in addressing the problems of desertification for achieving sustainable development.



(T.R.Baalu)

September 2001



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PREFACE

Desertification is a complex phenomena resulting from factors of physical, biological, socio-economic, cultural and political nature. Desertification is not confined to the desert areas or to the arid region, but relates to land degradation in about two-thirds of our country's geographical area falling within the arid, semi-arid and dry sub-humid regions. Land degradation has a direct impact on land and other natural resources which results in reduced agricultural productivity, loss of bio-diversity and vegetative cover, decline in groundwater and availability of water in the affected regions. All these lead to a decline in the quality of life, eventually affecting the socio-economic status of the region. A major part of our country is degraded in some form or other. In some regions, problems of land degradation have reached serious proportions threatening the very existence of the people.

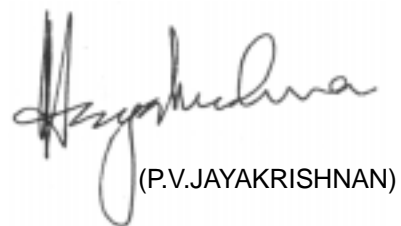
As our country moves further in the path of economic reforms for development, it is therefore important that, issues of environmental protection are given high priority and the negative consequences of environmental degradation are considered and addressed effectively for the sustainable development of our country. The planners, policy and decision makers and persons in political field have a major responsibility in discharging their functions keeping in view the complex but definite interrelationship between environmental conservation, human development and sustainable development.

The United Nations Convention to Combat Desertification (UNCCD) was adopted on 17th June 1994. The Convention stresses the need for integrated efforts and long-term strategies on cross-sectoral issues such as environmental conservation, agricultural productivity, sustainable energy and fodder production and use, efficient management of land, water and other natural resources, developmental activities for the local communities to improve their living standards. Thus the UNCCD provides a platform for addressing these issues not only in the national but also in the global context.

India became a signatory to the UNCCD on 14th October 1994 and it came into effect on 17th March 1997. One of the obligations of all developing country Parties to the Convention, including India, is to prepare the National Action Programme to Combat Desertification and to mitigate the effects of drought. The Ministry of Environment and Forests, as the National Focal Point for the implementation of the Convention, initiated the process of preparation of National Action Programme through the setting up of a High-Level Inter-Sectoral National Steering Committee (NSC) in July 1999. The NSC decided to constitute four Working Groups (WG) on various issues relevant to desertification. These are: WG#1- Desertification Monitoring and Assessment, WG#2- Sustainable Land Use Practices for Combating Desertification, WG# 3 - Local Area Development Programme, and WG# 4 - Policy and Institutional Issues.

The National Action Programme was formulated through a wide cross-sectoral consultative process involving a large number of Ministries, Departments and organisations at the Central and State levels. NGOs and grass roots level organisations were also consulted for their views and specific suggestions at various stages of the programme formulation. In addition, the formulation of National Action Programme was discussed with the international community – developed and developing countries, donors, international organisations and agencies.

The Report of the National Action Programme to Combat Desertification in the country comprises two-volumes. Volume-I-Status of Desertification in the Country provides an overview of the status of natural resources in the country, the status and impacts of desertification, the large number of measures under implementation, and in particular, the recent initiatives taken for combating desertification. Volume-II - is the National Action Programme for Combating Desertification in the Country, which is the perspective plan of action building upon the existing national efforts and priorities. The programme recognises the massive investment required to address the issues in a holistic manner on a long-term basis and the required financial and technical support and capacity building of the stakeholders for implementation of various activities thereunder. The National Action Programme seeks the support from the international community for funding a major part of the investment required for the formulation and implementation of specific activities envisaged under the Programme. We hope that the implementation of the National Action Programme will benefit all stakeholders to the Convention in combating desertification.



(P.V.JAYAKRISHNAN)

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The preparation of the National Action Programme involved detailed discussions with various stakeholders, collection, integration and analysis of a voluminous information and data from the Reports of the Working Groups, the final draft report of the consultant, various reports of the Government of India R&D institutions and other organisation. The documents of the UNCCD, and a number of national and international organisations were also consulted. The Ministry acknowledges all those who have contributed in the exercise of the formulation of the National Action Programme and in the preparation of the Report. The contributions made by the following deserve special mention:

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National Action Programme to Combat Desertification

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INDIA
NATIONAL ACTION PROGRAMME (NAP) TO COMBAT DESERTIFICATION

IN THE CONTEXT OF
UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

Volume-I STATUS OF DESERTIFICATION

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List of Acronyms Used in the Text

AAS	Agrometeorological Advisory Service
AER	Agro Ecological Regions
AESR	Agro Ecological Sub Regions
AFRI	Arid Forest Research Institute
AHWG	Ad-Hoc Working Group
AICPRDA	All India Coordinated Research Project for Dryland Agriculture
AICPRM	All India Coordinated Research Project on Agrometeorology
AISLUS	All India Soil and Land Use Survey
A&N Islands	Andaman & Nicobar Islands
AOFFPS	Area Oriented Fuelwood and Fodder Projects Scheme
AP	Andhra Pradesh
ARWSP	Accelerated Rural Water Supply Programme
BITS	Birla Institute of Technology and Science
BOP	Balance of Payment
BSY	Balika Samridhi Yojana
CADA	Command Area Development Authority
CAPART	Council for Advancement of People's Action and Rural Technology
CASE	Commission for Additional Sources of Energy
CAZRI	Central Arid Zone Research Institute
CBD	Convention of Biological Diversity
CBMS	Community Based Monitoring System
CBOs	Community Based Organisations
CCD	Convention to Combat Desertification
CGWB	Central Ground Water Board
CGWA	Central Ground Water Authority
COP	Conference of the Parties
COW	Committee of the Whole
CPCB	Central Pollution Control Board
CPRs	Common Property Resources
CPRLs	Common Property Resource Lands
CRF	Calamity Relief Fund
CRIDA	Central Research Institute for Dryland Agriculture
CSD	Commission on Sustainable Development
CST	Committee on Science & Technology
CRIC	Committee to Review the Implementation of the Convention
CSWCRTI	Central Soil and Water Conservation Research & Training institute
CWC	Central Water Commission
DAC	Department of Agriculture and Cooperation
DARE	Department of Agricultural Research and Education
DA&SCS	Desert Afforestation and Soil Conservation Station
DC	District Collectors
DDP	Desert Development Programme
DFO	District Forest Officer
DM	District Magistrates
DMC	Drought Monitoring Cell
DOLR	Department of Land Resources
D&N Haveli	Dadra & Nagar Haveli
DNES	Department of Non-Conventional Energy Sources
DOS	Department of Space
DPAP	Drought Prone Area Programme
DRDAs	District Rural Development Agencies
DST	Department of Science and Technology
EAP	Environment Action Programme
EAS	Employment Assurance Scheme
E&F	Environment & Forests
ENVIS	Environmental Information System

National Action Programme to Combat Desertification

ESCAP	Economic and Social Commission for Asia and Pacific
ETC	Extension Training Centre
ETFs	Eco Task Forces
EWS	Early Warning Systems
FAO	Food and Agricultural Organisation
FCA	Forest (Conservation) Act, 1980
FINCA	Foundation for International Community Assistance
FPC	Fuel Policy Committee
FPRs	Flood Prone Rivers
FSI	Forest Survey of India
FYM	Farm Yard Manure
GDI	Gender Development Index
GEF	Global Environmental Facility
GIS	Geographic Information System
GM	Global Mechanism
GOI	Government of India
GREEN	Growth with Resource Enhancement of Environment and Nature
GRULAC	Countries of Latin America & Caribbean
Ha	hectares
HDI	Human Development Index
HP	Himachal Pradesh
HPC	High Power Committee
HPI	Human Poverty Index
IAEPs	Integrated Area Eco-development Projects
IARI	Indian Agriculture Research Institute
IBRD	International bank for Reconstruction and Development
ICAR	Indian Council of Agricultural Research
ICDS	Integrated Child Development Services
ICFRE	Indian Council of Forestry Research and Education
ICRISAT	International Crop Research Institute for Semi-Arid Tropics
IEG	International Expert Group
IFAD	International Fund for Agriculture and Development
IGCMC	Indira Gandhi Conservation Monitoring Centre
IIPA	Indian Institute of Public Administration
INM	Integrated Nutrient Management
IMD	India Meteorological Department
IMK	Indira Mahila Kendra
IMSD	Integrated Mission on Sustainable Development
IMY	Indira Mahila Yojana
INCD	Intergovernmental Negotiating Committee
IPM	Integrated Pest Management
IPS	Investment Promotional Scheme
IREDA	Indian Renewable Energy Development Agency
ITK	Indigenous Technical Knowledge
IWDP	Integrated Wasteland Development Programme Scheme
JFM	Joint Forest Management
J&K	Jammu & Kashmir
JGSY	Jawahar Gram Samridhi Yojana
JRY	Jawahar Rozgar Yojana
KVKs	Krishi Vigyan Kendras
LADPs	Local Area Development Programmes
LADA	Land Degradation Assessment
LADF	Local Area Development Fund
LEISA	Low External Input Sustainable Agriculture
LSG	Local Self Governments
MCs	Meteorological Centres
MA	Millennium Ecosystem Assessment
mha	million hectares
MNES	Ministry of Non-Conventional Energy Sources
MNP	Minimum Needs Programme

National Action Programme to Combat Desertification

MOA	Ministry of Agriculture
MOEF	Ministry of Environment and Forests
MOHRD	Ministry of Human Resource Development
MORA&E	Ministry of Rural Areas & Employment (former name of MORD)
MORD	Ministry of Rural Development
MOWR	Ministry of Water Resources
MP	Madhya Pradesh
MSW&E	Ministry of Social Welfare and Empowerment
NABARD	National Agriculture Bank for Rural Development
NADAMS	National Agricultural Drought Assessment and Monitoring System
NAEB	National Afforestation and Eco-Development Board
NAP	National Action Programme
NARP	National Agricultural Research Project
NARS	National Agricultural Research System
NATMO	National Atlas and Thematic Mapping Organisation
NBCFDC	National Backward Classes Finance and Development Corporation
NBSSLUP	National Bureau of Soil Survey and Land Use Planning
NCA	National Commission on Agriculture
NCAER	National Council of Applied Economic Research
NCDM	National Centre for Disaster Management
NCMRWF	National Centre for Medium Range Weather Forecasting
NCPEC	National Committee on Environmental Planning and Coordination
NCS	National Conservation Strategy
NDC	National Development Council
NDF	National Desertification Fund
NDVI	Normalised Difference Vegetation Mapping
NFAP	National Forestry Action Programme
NFP	National Forest Policy
NGOs	Non-Governmental Organisations
NHRDP	National Human Resource Development Programme
NIC	National Informatics Centre
NIRD	National Institute of Rural Development
NISTADS	National Institute of Science, Technology and Development Studies
NLCB	National Land Conservation Board
NLWC	National Land Use and Wasteland Development Council
NMDFC	National Minorities Development and Finance Corporation
NPE	National Policy of Education
NRCAF	National Research Centre for Agroforestry
NRCD	National River Conservation Directorate
NRM	Natural Resource Management
NRSA	National Remote Sensing Agency
NSC	National Steering Committee
NSFDC	National Scheduled Castes and Scheduled Tribes Finance & Development Corporation
NSKFDC	National Safai Karamchari Finance & Development Corporation
NTFP	Non-Timber Forest Produce
NWDPRA	National Watershed Project for Rainfed Area
OBCs	Other Backward Communities
PAs	Protected Areas
PACD	Plan of Action to Combat Desertification
PDS	Public Distribution System
P	Precipitation
PE orPET	Potential Evapotranspiration
PIA	Project Implementation Agency
PLVD	Productive Land Vulnerable to Desertification
PRI	Panchyati Raj Institution
RAP	Regional Action Programme
RCH	Reproductive and Child Health Programme
RGNDWM	Rajiv Gandhi National Drinking Water Mission
RIDF	Rural Infrastructure Development Fund
RIOD	Reseau International des ONG sur la Des'ertification (International NGO Network on

National Action Programme to Combat Desertification

	Desertification and Drought)
RVP	River Valley Project
RWP	Rural Works Programme
SAC	Space Applications Centre
SAT	Semi Arid Tropics
SC	Scheduled Caste
SCDC	Scheduled Caste Development Corporation
SHGs	Self Help Groups
SIRD	State Institute of Rural Development
SLUBs	State Land Use Boards
SDNP	Sustainable Development Networking Programme
SOE	State of Environment
SOM	soil Organic Matter
SPCB	State Pollution Control Boards
SPWD	Society for Promotion of Wastelands Development
SRAP	Sub Regional Action Programme
ST	Scheduled Tribe
STEP	Support to Training & Employment Programme for Women
TDET	Technology Development, Extension & Training
TERI	Tata Energy Research Institute
TN	Tamil Nadu
TPN	Thematic Programme Network
UEE	Universalisation of Elementary Education
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNCOD	United Nations Conference on Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention of Climate Change
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNSO	United Nations Office to Combat Desertification and Drought
UP	Uttar Pradesh
UTs	Union Territories
VAs	Voluntary Agencies
VFCs	Village Forest Committees
VMP	Village Management Plans
WAs	Watershed Associations
WB	World Bank
WB	West Bengal
WDF	Watershed Development Fund
WDPSCA	Watershed Development Project for Shifting Cultivation Areas
WGs	Working Groups
WMO	World Meteorological Organisation
WWF	World Wide Fund for Nature
ZP	Zilla Parishad

Numerical Equivalents

1 Lakh = 100,000

10 lakhs = 1 Million = 1000,000

100 lakhs = 10 Million = 1 Crore = 10,000,000

OVERVIEW OF THE REPORT

The Report contains 11 Chapters. These are:

Chapter	Issues Presented
Chapter 1: Introduction	The chapter gives a brief outline of the genesis of the UNCCD. It explains the term 'drylands' and 'desertification', the objectives of the Convention and the specific obligations of the various Parties to the Convention.
Chapter 2: Status of Drylands and Desertification in the World	This chapter gives an overview of the dryland regions and status of desertification in the world, and in Asia.
Chapter 3: India- General Profile, Land Use Classification and Land Use Pattern	This Chapter gives a general profile of India -physical, natural resources, socio-economic status. Land and land use classification, land use pattern and land use changes.
Chapter 4: Desertification Monitoring and Assessment	Provides an overview of various assessments and surveys carried out on status of land degradation in the country. Also has a sub-section on drought and use of early warning systems for drought mitigation.
Chapter 5: Factors, Processes and Impacts of Desertification in India	This chapter provides an account of the various factors and processes of desertification in India and their impacts.
Chapter 6: Measures to Combat Desertification & Drought Mitigation In India	This chapter gives a detailed account of the various policies, strategies, plans and programmes in the country for combating desertification in the country. The Chapter also provides a detailed account of the various technologies available in the country for combating desertification. The has been broadly categorised into: (i) technologies for conservation of natural resources, (ii) for controlling land degradation and land reclamation and (iii) technologies specifically for drought mitigation. A separate section on use of traditional technologies is also presented.
Chapter 7: New initiatives	This chapter gives an overview of the new initiatives taken by the Government during the past decade for natural resource conservation and combating desertification.
Chapter 8: Other Activities under the UNCCD and their Inter-Linkages with NAP-India	This chapter explains the activities under the Convention. It also provides an overview of the various regional, sub-regional action programmes under the Convention. A section on the funding mechanisms available under the Convention is also presented.
Chapter 9: Issues & Recommendations	This chapter explains the gaps and constraints in the on-going efforts and makes recommendations on important issues relating to combating desertification in the country.
Chapter 10: Formulation of National Action Programme	Using the issues presented in the earlier chapters, this chapter proposes options for formulation of National Action Programme
Chapter 11: Conclusions	Brief Conclusions

CHAPTER 1

Introduction

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Chapter 1

Introduction

Highlights of Chapter 1

This chapter introduces the genesis of the UNCCD. The Chapter also explains in brief, the general provisions and obligations and those specific to different regions in the world. Those provisions and obligations relevant to our country, as an affected developing country Party in Asia, have been described in detail. The other important issue is the approach recommended by CCD for combating desertification in a sustainable manner.

1.1. Genesis of the CCD

Desertification has long been recognised as a major environmental problem affecting the living conditions of the people in the affected regions in many countries of the world. In 1977, a United Nations Conference on Desertification (UNCOD) was convened in Nairobi, Kenya to produce an effective, comprehensive and co-ordinated programme for addressing the problem of land degradation. UNCOD was an outcome of extensive studies and consultations undertaken at the global, regional and local level involving scientist, policy and decision makers and experts from R&D institutions and other organisations from all over the world (UNEP, 1991). The UNCOD recommended the United Nations Plan of Action to Combat Desertification (PACD). However, the implementation of PACD was severely hampered by limited resources. Assessments made in 1984, 1987 and 1989 by UNEP indicated that desertification continued to spread. The UN Commission for Sustainable Development Report 1988 observed that desertification had become one of the most serious environmental and socio-economic problems of the world. The various assessments by UNEP continued to point out that desertification results from complex interactions among physical, chemical, biological, socio-economic and political problems that were local, national and global in nature.

In 1992, UNEP produced a World Atlas of Desertification (UNEP 1992 b). The studies indicated that over the preceding 20 years, the problem of land degradation had continued to worsen. In the past, drylands recovered easily following long droughts and dry periods. Under modern conditions, however, they tend to lose their biological and economic productivity quickly unless they are managed in a sustainable manner. The studies further indicated that over-cultivation, overgrazing, deforestation, and poor irrigation practices are degrading drylands in every continent. The major factors for this are population (human and livestock) pressures, inappropriate land use and agricultural practices, social conflicts and drought. Desertification was recognised as a major global concern affecting over 250 million people directly and with over one billion (more than one-fifth of the world's population) at risk, changing the traditional lifestyle, culture and composition of the rural societies.

The UN Conference on Environment and Development (UNCED) (also known as the Earth Summit) held in Rio de Janeiro, Brazil in June 1992 provided a platform for addressing a number of major global environmental concerns such as climate change, biodiversity, deforestation. The Rio Summit also highlighted the problem of desertification and recommended that the United Nations General Assembly establish an Intergovernmental Negotiating Committee (INCD) to prepare a Convention to Combat Desertification in those countries experiencing serious drought and/or desertification, particularly in Africa. The Committee was established in early 1993. It held five preparatory sessions before adopting the Convention on 17th June 1994 in Paris. The Convention was opened for signature on 14-15 October 1994. The Convention entered into force on 26th December 1996, 90 days after 50 countries had ratified it. As on 10th December 2000, 172 countries have acceded/ratified the Convention (Annex.1: Status of Ratification of the UNCCD).

India was an active member of the INCD process and became a signatory on 14th October 1994 (the day it was opened for signature). India ratified the Convention on 17th December 1996 and it came into force in our country with effect from 17th March 1997 (90 days after the date of ratification). Agenda 21, which was also an outcome of the Rio Summit, provides a blueprint of the line of action on various issues relating to sustainable development in the 21st century. Agenda 21 contains 40 Chapters of which Chapter 12 is on desertification, which addresses the global scope of the problem. A summary of the genesis of the CCD process is given in Fig.1.1.

1.2. Definition of Desertification in the UNCCD

The term 'desertification' was employed in 1949 by the French forester Aubreville, who used the term to refer to the displacement of tropical rainforest by secondary savannah and scrub in those parts of Africa where forest was being cleared and burned to provide land for cultivation (WMO-UNEP, 1996). Aubreville concluded that the process was especially active in the sub-humid tropics of Africa and was akin to the creation of deserts in the formerly forested areas. The extent of accelerated soil erosion induced by indiscriminate felling and burning of forest and woodland in Africa and changes in the soil-water budget and hydrological cycle were understood as some of the factors leading to land degradation. There was also a growing recognition of the part played by human activities and climate changes such as prolonged or frequent droughts aggravating land degradation. **This led to formally defining desertification as "land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities" (UNCED, 1992) *, which is used as the basis of the UNCCD.**

Aridity of a region is categorised by the ratio of $P = \text{Mean Annual Precipitation}$ to $PE = \text{Mean Annual Potential Evapotranspiration}$, using modified Thornthwaite formula. As per this, the aridity zones are classified as given in Table:1.1.

*UNCED (1992): Earth Summit Agenda 21: Programme of Action for Sustainable Development. New York: UN Department of Public Information quoted in WMO-UNEP, 1996.

Table 1.1: Classification of the Regions on the basis of aridity index

Climate Zone	P/PE ratio	% of world covered
Hyper-arid	<0.05	7.5
Arid	0.05-0.20	12.5
Semi-arid	0.21-0.50	17.5
Dry sub-humid	0.51-0.65	9.9
Humid	> 0.65	39.2
Cold	> 0.65	13.6

Source of Inf.: WMO-UNEP Report (1996): Interactions of Desertification and Climate

The “drylands” are defined as those regions where the ratio of the mean annual precipitation to the mean annual evapotranspiration is in the range of 0.05-0.65. It is important to note that the CCD considers arid, semi-arid and dry sub-humid regions as dryland, but excludes the **hyper-arid region**, where the P/PE ratio is less than 0.05, from the ambit of the Convention. The Convention also excludes the **moist sub-humid, humid and perhumid zones** of various regions in the world.

1.3. Convention to Combat Desertification

The Convention document is broadly divided into six main Parts and with four Annexes (Annex-2). These broadly deal with items (I) Introduction- giving the definition of terms of Objectives and Principles, (II) General Provisions including Obligations, (III) Action Programmes, Scientific & Technical Co-operation and Supporting Measures, (IV) Institutions of the CCD, (V) Procedures, and (VI) Final Provisions. There are four Regional Implementation Annexes - (I) Africa, (ii) Asia, (iii) Latin America & Caribbean, and (iv) Northern Mediterranean. Each of these Annex give details of scope, purpose, obligations and procedures for implementation of the Convention.

1.4 Objectives of the Convention

The most important objective of the Convention is to combat desertification occurring in the dryland regions of the world and to mitigate the effects of drought. Desertification is due to complex interactions among physical, biological, social, cultural and economic factors. Desertification impacts the economic growth of not only the affected region, but also the countries as a whole, their social and economic development. Desertification and drought affect the sustainable development through their interrelationships with important social problems such as poverty, poor health and nutrition, lack of food security, and those arising from these such as migration, social conflicts and unrest. The Convention emphasises the need to address these in an integrated manner.

Box. 1.1. Other Definitions in the CCD

“**Land**” means the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system.

“**Land degradation**” means reduction or loss in arid, semi-arid and dry sub-humid areas of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from landuses or from a process or combination of processes, including processes arising from human activities and habitation patterns such as:

- (i) soil erosion caused by wind and/or water;
- (ii) deterioration of the physical, chemical and biological or economic properties of the soil;
- (iii) long-term loss of natural vegetation.

“**Dryland**” refers to the arid (excluding the polar and sub-polar regions), semi-arid and dry sub-humid areas in which the annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65.

“**Combating desertification**” includes activities which are part of the integrated development of land in arid, semi-arid, and dry sub-humid areas for sustainable development which are aimed at:

- (i) prevention and/or reduction of land degradation;
- (ii) rehabilitation of partly degraded land; and
- (iii) reclamation of desertified land.

“**Drought**” means the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems.

1.5 Obligations under the Convention

Under the Convention, the most important obligation of the affected developing country Parties is to prepare a National Action Programme to combat desertification and mitigate the effects of drought.

Box. 1.2. Part II - Article 5 of the UNCCD: Obligations of the Affected Developing Country Parties

- Give due priority to combating desertification and mitigating the effects of drought.
- Establish strategies and priorities within the framework of sustainable development.
- Address underlying causes of desertification and particularly to the socio-economic factors contributing to the desertification process.
- Promote awareness and facilitate the participation of local populations, particularly the women and youth, non-governmental organisations, in efforts to combat desertification and mitigate the effects of drought.
- Provide an enabling environment by strengthening the relevant existing legislation, enacting new laws, where they do not exist, and establish long-term policies and action programmes.

Part III Section 1, Articles 9 & 10 National Action Programmes

All affected developing country Parties shall prepare a National Action Programme, utilising and building to the extent possible, on existing relevant plans and programmes and sub-regional and regional action programmes, as the central element of strategy to combat desertification and drought.

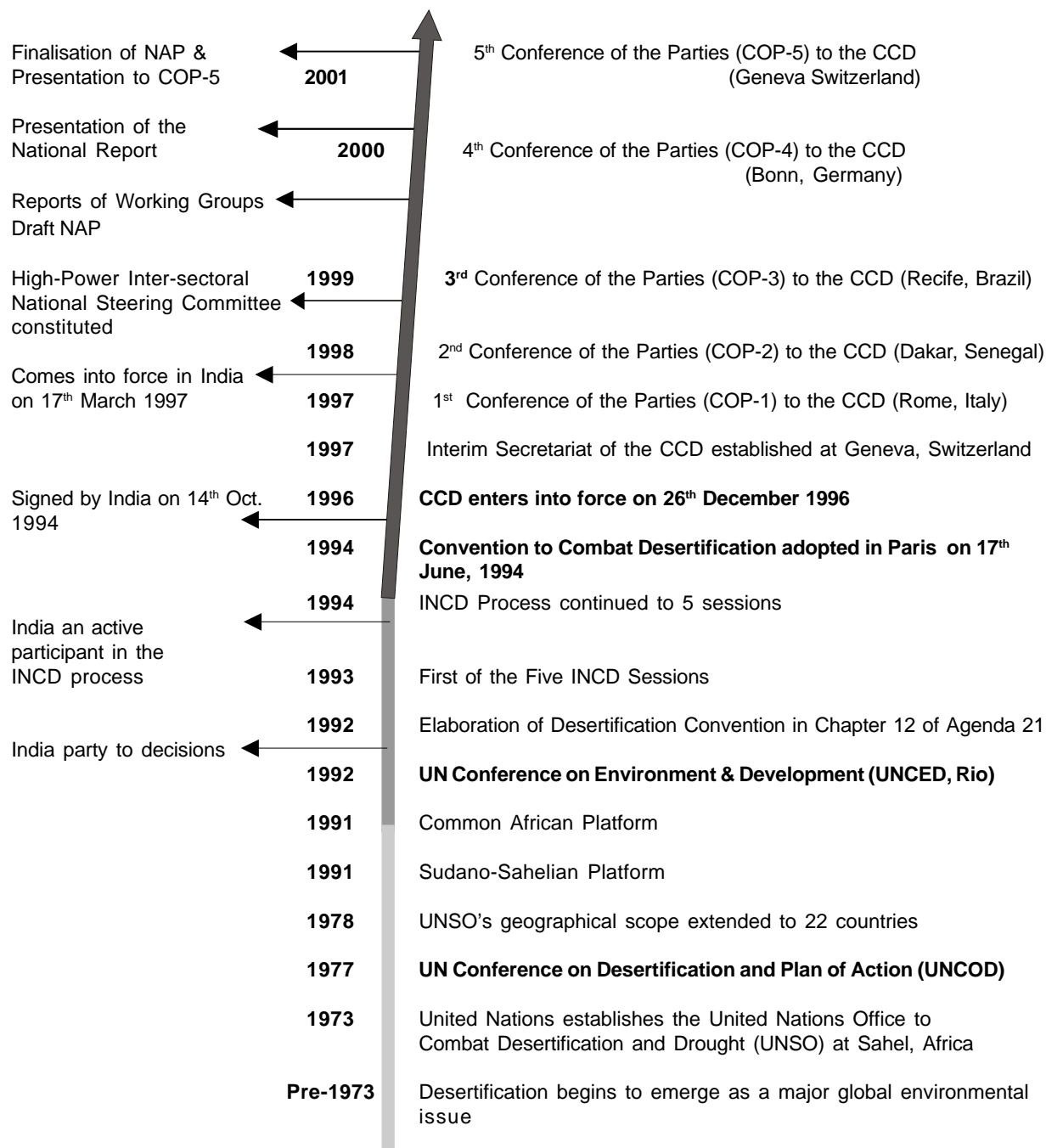


Fig: 1 GENESIS OF THE CCD

Modified from UNDP(1998) - UNDP Programme Activity Report-1995-1998.

The NAP envisaged in Article 10 of the CCD needs to be prepared and amended from time to time keeping in mind:

- (i) the basic approach and existing relevant successful plans and programmes referred to in Article 9, and support measures referred to in Article 13.
- (ii) the objective of the CCD and the long-term integrated strategies referred to in Article 2.
- (iii) the principal referred to in clause (a) of Article 3.
- (iv) the obligations of the Government of India under Article 4.1, 4.2 (a), 4.2 (c), 4.2 (g), 5, 11, 12 and 14.
- (v) the relationship of the CCD with the Convention on Climate Change and the Convention on Biological Diversity referred to in Article 8.
- (vi) the framework referred to in Article 3 of the Asia Annex.
- (vii) the matters listed in Article 4 of the Asia Annex.

The obligations of the developed country Parties include actively support the effects of affected developing country Parties to combat desertification and drought.

Box. 1.3. Part II - Article 6: Obligations of Developed Country Parties
<ul style="list-style-type: none">• Providing substantial financial resources.• Promote the mobilisation of new and additional funding.• Promote and facilitate to appropriate technology and know-how.

These include providing substantial financial resources, promote the mobilisation of new and additional funding, and promote and facilitate to appropriate technology and know-how. It is important to note that as per Article 9 of Annex-4 of the CCD, the affected Developed Country Parties are not eligible for support under the Convention.

1.6 CCD Approach for Preparation of a National Action Programme

The overall emphasis in the NAP is on integrated development programmes in the affected areas (Article 4.2., Asia Annex), and an iterative system of formulation and implementation of specific practical measures suggested in Articles 10.2 (f) and 13.1 (c). Most importantly, NAP preparation should be preceded by a survey of the state of the environment in the affected areas to assess the causes and consequences of desertification in specific areas and to determine priority areas for action (Article 4.1 (c), Asia Annex), and should take into account the assessments based upon systematic observations referred to in Article 16 and evaluations referred to in Article 4.1 (f), Asia Annex.

The NAP is also expected to spell out its linkages with resource-users, grassroots level organisations (NGOS, CBOs and VAs) working at community level, policy and decision makers at various levels, programmes of co-operation with other Governments, international organisations and donor agencies, synergies amongst the various Rio Conventions and recommend a plan of action for addressing the problems of land degradation in the dryland regions of the country. The Convention attempts to integrate all the elements relating to land resources, landuse and land degradation. It calls for effective action of people at all levels, particularly the local people - the landusers, including civil society. It pays particular attention to the active involvement of rural women and their economic upliftment.

Therefore, the basic objective of the Convention is to prepare long-term integrated strategies, which are an integral part of broader national policies and plans for sustainable development. that help in achieving the objective of conservation and protection of the environment by focusing simultaneously on the most affected areas, in terms of afforestation, improved productivity of land, conservation and sustainable management of land and water resources in particular at the community level, leading to improved living conditions. Thus the Convention addresses issues such as environmental conservation, agricultural productivity, sustainable energy and fodder production and use, developmental activities for local communities and their rehabilitation in degraded lands and such other related issues such as health, literacy and social improvement through employment to improve their living standards.

The NAP is also required to have an in-built system of review, evaluation and documentation of the formulation and implementation of the NAP leading to the discharge of the obligation to report to the Conference of the Parties to the CCD.

Box. 1.4 CCD Approach to Desertification (Elements of the CCD) which is the basis of NAP

- Long-term Integrated strategies with identified priorities of action.
- Consider all aspects of the problem – receding water table, loss of agricultural productivity, reduced vegetation cover, socio-economic losses, social instability, etc.
- Integration with other development programmes.
- Key role of local communities.
- Policy measures to provide an ‘enabling environment’ for such an approach.
- Resources required - that available and those still needed to be identified.

This approach is to be followed in the formulation and implementation of the National Action Programme.

Chapter 2

Status of Drylands and Desertification in the World

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Chapter 2

Status of Drylands and Desertification in the World

Highlights of Chapter 2

Drylands are inhabited by approximately 2 billion people globally accounting for nearly 40% of the world's population. Asia has the largest area under drylands, which is home to over 1.3 billion people, i.e. accounting for over three-quarters of the total population in drylands worldwide. Asia amongst all regions in the world is the most affected - both in terms of area affected and the population threatened or at risk due to desertification. Even within the Asian Region, land degradation in India is of concern both in terms of per capita availability of arable land and natural resources such as forestry, which is one of the lowest in the world. This poses great challenge to our country in terms of meeting the food-fuel-fodder requirements in the coming decades.

2.1. World

Drylands are inhabited by approximately 2 billion people globally accounting for nearly 40% of the world's population. Approximately 54 million sq.km or 40% of the land area can be classified as drylands. Regions-wise, Africa is relatively driest of the continents. Even in South America, known for its rainforests, about a third of the land is in dry zones. Asia also contains substantial drylands, with 39% of its total land mass mostly of the arid, semi-arid categories found in Central Asia and Western China. The largest number of population is concentrated in the drylands with Asia having the highest - 42% of its total population, i., about 1.5 billion people living in the drylands, Africa has 41%, and South America has 30%. These inhabit mainly the semi-arid and sub-humid regions. Thus, countries with high proportion of their population in the drylands should also be at risk to dryland degradation. Some of the world's largest cities lie within the dry zones - Beijing, Cairo, Lima, Dakar. The hyper-arid region, which are excluded from the drylands, account for 9.9% of the global land area (Tables 2.1 & 2.2).

2.1.1. Extent and Distribution of Drylands

Table 2.3: Extent and Distribution of Susceptible Drylands, by continent. (UNEP, 1992a)

Region	Area (mha)	Percentage of Total
Africa	1,286	43
Asia	1,672	39
Australia	663	>75
Europe	300	31
N.America	732	33
S.America	516	29
World Total	5,169	40

Table 2.1: EXTENT OF DRYLANDS IN DIFFERENT CONTINENTS OF THE WORLD (area numbers are in thousands of square km)

CONTINENT	HYPER-ARID	%	ARID	%	SEMI-ARID	%	DRY SUB-HUMID	%	TOTAL DRYLANDS (ARID+SEMI-ARID + DRY SUB-HUMID)	MOIST SUB-HUMID +HUMID	%	COLD	%	GRAND TOTAL
Africa	8,099	27	5,052	17	5,073	17	2,808	9	12,933	9,171	30	0	0	30,203
Americas & Caribbean	268	1	1,201	3	7,113	17	4,556	11	12,870	16,926	41	11,577	28	41,641
Asia	2,744	6	6,164	13	7,649	16	4,558	9	18,371	14,997	31	12,082	25	48,223
Australia & Oceania	0	0	3,488	39	3,532	39	996	11	8,016	1,019	11	0	0	9,035
Europe	0	0	5	0	373	7	961	17	1339	4,059	71	289	5	5,687
World Total	11,110	8	15,910	12	23,740	18	13,879	10	53,529	46,512	34	23,948	18	134,789

Table 2.2: EXTENT OF DRYLANDS IN DIFFERENT CONTINENTS OF THE WORLD (Population numbers are in thousands)

CONTINENT	HYPER-ARID	%	ARID	%	SEMI-ARID	%	DRY SUB-HUMID	%	TOTAL DRYLANDS (ARID+SEMI-ARID + DRY SUB-HUMID)	MOIST SUB-HUMID +HUMID	%	COLD	%	GRAND TOTAL
Africa	58,068	9	40,503	6	117,649	18	109,370	17	267,522	326,129	50	0	0	651,719
Americas & Caribbean	4,387	1	19,081	3	100,753	14	581,201	8	701,035	510,820	73	10,359	1	703,520
Asia Australia &	29,506	1	161,554	5	625,411	18	657,899	19	1,444,864	1,942,210	56	29,902	1	3,446,483
Oceania	0	0	275	1	1,342	5	5,318	19	6935	20,447	75	0	0	27,380
Europe	0	0	629	6	28,716	5	115,216	20	144,561	417,026	74	8,573	2	566,161
World Total	91,961	2	222,042	4	873,871	16	1,469,004	17	2,564,914	3,216,632	60	49,834	1	5,395,263

Source of Inf: UNDP/UNSO - An Assessment of Population Levels in the World's Drylands.

Socio-economic factors and political considerations play a very significant role in land degradation occurring in the various regions of the world. However, population levels can trigger or intensify land degradation, all other factors and assumptions being equal. This assumption is based on the existence of an inherent carrying capacity for a given land type with a given land use.

2.1.2. LINKAGE BETWEEN DESERTIFICATION AND POVERTY IN DRYLANDS OF THE WORLD

According to the 1997 UNDP Human Development report, poverty is worse in drier zones than it is in wetter zones. For example, for 10 countries of the Sahel Region in Africa, the Human Poverty Index was 25% of the humid areas and 61% for arid zones. To gain a better understanding of the link between drylands and the UNDP human development index, which provides a measure of the socio-economic development, UNSO undertook an analysis of some 90 countries. On that basis, the countries were classified into three clusters:

- Cluster 1: Low HDI, PLVD >35%.
- Cluster 2: Medium HDI, PLVD>35%
- Cluster 3: Others.

Where, HDI = Human Development Index, and PLVD = Productive Land Vulnerable to Desertification. The classification of the countries based on their vulnerability to degradation and human development is given in Table 2.4. India falls in Cluster 1 countries with a low Human Development Index (HDI) and with more than 35% of its productive land vulnerable to desertification (PLVD). China falls in Cluster 2 with a medium HDI and with greater than 35% PLVD.

Table 2.4: LINK BETWEEN DESERTIFICATION AND POVERTY IN COUNTRIES FROM DIFFERENT REGIONS

Latin America & Caribbean (GRULAC)	Europe & CIS	Africa	Arab States	Asia & Pacific
Argentina (3)	Armenia (3)	Angola (1)	Algeria (2)	Afganistan (1)
Barbados (3)	Bulgaria (3)	Benin (1)	Bahrain (2)	China (2)
Bolivia (1)	Georgia (3)	Botswana (2)	Djibouti (1)	India (1)
Brazil (2)	Kazhakstan (2)	Burkina Faso (1)	Egypt (1)	Iran (2)
Chile (3)	Kyrgyzstan (3)	Cameroon (3)	Iraq (2)	Mongolia (2)
Colombia (3)	Tajikistan (3)	Cape Verde (1)	Jordan (2)	Pakistan (1)
Costa Rica (3)	Turkey (2)	Central American Republic (3)	Kuwait (3)	Sri Lanka (3)
Cuba (3)	Turkmenistan 2)	Chad (1)	Lebanon (2)	
Dominican Republic (3)	Uzbekistan (2)	Cote d' Ivoire (3)	Libya (2)	
Ecuador (3)		Eritrea (1)	Morocco (2)	
El Salvador (3)		Ethiopia (1)	Oman (2)	
Guatemala (3)		Gambia (1)	Qatar (3)	
Haiti (3)		Ghana (3)	Saudi Arabia (2)	
Honduras (3)		Guinea (3)	Somalia (1)	
Jamaica (3)		Guinea Bissau (3)	Sudan (1)	
Mexico (3)		Kenya (1)	Syria (2)	
Nicaragua (3)		Lesotho (1)	Tunisia (2)	
Panama (3)		Madagascar (3)	U.A.Emirates (2)	
Paraguay (2)		Malawi (1)	Yemen (1)	
Peru (3)		Mali (1)		
Venezuela (3)		Mauritania (1)		
		Mozambique (1)		
		Namibia (1)		
		Niger (1)		
		Nigeria (1)		
		Senegal (1)		
		South Africa (2)		

		Swaziland (1) Tanzania (1) Togo (3) Uganda (3) Zambia (1) Zimbabwe (1)		
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Source: UNDP: Programme Activity Report 1995-1998.

Cluster 1:Low HDI, PLVD >35%, Cluster 2:Medium HDI, PLVD>35%, Cluster 3: Others.

Where, HDI-Human Development Index, PLVD-Productive Land Vulnerable to Desertification

According to the UNDP Human Development Report 2001, India is ranked 115 amongst 162 nations evaluated in terms of human development (Table 2.5). Even within the Asian region, countries such as Sri Lanka (ranked 81), Thailand (66), Malaysia (56) are ahead in terms of socio-economic and human development. Ranking of other countries in the South Asian sub-region include Pakistan (127), Bhutan (130), Nepal (129), and Bangladesh (132).

2.1.3. LAND USE IN DIFFERENT DRYLAND REGIONS OF THE WORLD

A comprehensive survey (UNEP, 1992a¹) indicated that the dominant forms of land use and land cover in drylands are irrigated and rainfed agriculture and rangelands, with forest and woodland occupying upto a quarter of all drylands. The survey concluded that 73% of the rangelands, 47% of the rainfed croplands and 30% of the irrigated areas showed some degree of desertification Table 2.6). It may however be mentioned that global assessments of this nature can vary from survey to survey based on the criteria used.

Table 2.6: Dominant Types of Human Land Use (in mha) in the Susceptible Drylands (UNEP, 1992a)

Region	Irrigated Croplands	Rainfed Croplands	Rangelands	Total
Africa	10,424	79,822	1,342,345	1,432,591
Asia	92,021	218,174	1,571,240	1,881,435
Australia	1,870	42,120	657,223	701,213
Europe	11,898	22,106	111,570	145,574
N.America	20,867	74,199	483,141	578,207
S.America	8,415	21,346	380,901	410,662
World Total	145,495	457,767	4,556,420	5,159,682

2.2 Asia

2.2.1 Extent of Desertification : Preliminary results of UNDP/UNSO carried out with the support of the World Resources Institute (WRI), indicate that Asia has the largest area under drylands and is home to over 1.3 billion people, over three-quarters of the total population in drylands worldwide. For most of these people, the natural resource base constitutes the primary source of livelihood. Also, the density of the population in the drylands of Asia is 3.7-4.0 times higher than in Africa and Latin America and the Caribbean respectively. Asia has 1949 million hectares of drylands, which is 46% of the continent's and 32% of the

¹ Status of desertification and implementation of the United Nations Plan of Action to Combat Desertification. Report of the Executive Director, Nairobi: United Nations Environment Programme.

Table 2.5: Human Development Status of some Selected Countries from Different Regions in the World in Comparison to India

Human Development Parameters	United States	Japan	Argentina	Brazil	China	India	Pakistan	Bangladesh	World Average	High Human Dev.	Medium Human Dev.	Low Human Dev.
Life Expectancy at birth (years) 1999)	76.8	80.8	73.2	67.5	70.2	62.9	64.4	59.6	66.7	77.3	66.8	52.6
Adult literacy rate (% age 15 & above) 1999	99.0	99.0	96.7	84.9	83.5	56.5	45.0	40.8	78.8	98.5	76.9	48.8
Population with access to improved water sources (1999)			79.0	83.0	75.0	88	88	97	27.0			
With access to essential drugs (%) 1999	100	100	70	40	85	35	65	65				
With access to (%) adequate sanitation (1999)			85	72	38	31	61	53				
Total Population (millions) (1999)	280.4	126.8	36.6	168.2	1264.8	992.7	137.6	134.6				
Expected Popln. (2015) In Millions	321.5	127.5	43.5	201.4	1410.2	1230.5	204.3	183.2				
Annual Pop. Growth Rate (%) 1975-1999	1.0	0.5	1.4	1.8	3.8	2.0	2.8	2.4	1.6	0.7	1.7	2.7
(%) 1998-2015	0.8	0.0	1.1	1.1	2.5	1.3	2.5	1.9	1.2	0.4	1.0	2.5
Female Adult literacy (% age 15 & above) (1999)	—	—	96.7	84.9	75.5	44.5	30.0	29.3	—	—	69.7	38.9
Total Fertility Rate (TFR) (No./Female) (1995-2000)	2.0	1.5	2.6	2.3	1.8	3.3	5.5	3.8	2.8	1.7	2.6	5.6
Infant Mortality Rate (per 1000 live births) (1998)	7	4	19	34	33	70	84	58	56	7	46	99
Public Education Exp. As % of total Govt. Exp(1995-97)	14.4	9.9	12.6	—	12.2	11.6	7.1	13.8	—	—	—	—
GDP per capita (US\$), 1999	31,872	24,898	12,277	7037	3617	2248	1834	14830	6,980	23,410	3850	1200
Overall ranking in Human Dev. Index (HDI) \$	6	9	34	69	87	115	127	132	—	—		
Gender-related Development Index (GDI)	4	9	33	64	76	105	117	121				
Human Poverty Index (HPI) in Developing Countries				18	24	55	65	73	—	—	—	—

Expl. Note: U.S, Japan and Argentina are grouped under Category of countries showing high human dev., Brazil, China, & India are grouped with countries showing medium Human Dev., Pakistan & Bangladesh are grouped with countries showing low human dev. \$ A total of 162 countries were evaluated for this study.

Source: Human Development report, UNDP, 2001

world's total surface area. The World Atlas for Desertification, 1992 has indicated 370.4 million hectares to be degraded. About 35% of the region's productive land are under severe threat of desertification, resulting in an enormous loss of productivity. This covers about 35% of all irrigated land, 56% of the rain-fed cropland and 76% of the rangelands.²

2.2.2 Status of Drylands in Asia: The United Nations Environment Programme (UNEP) has estimated that desertification affects more than 1,341 mha of productive land in Asia. The Global Assessment of Human Induced Soil Degradation (GLASOD) assessed that lost productivity through desertification in Asia is ranked as the worst among the regions in the world. The losses in investment and potential production per unit in Asia were the greatest compared to other regions. More than 50% of the world's irrigated lands affected by waterlogging and salinisation are also found in Asia, touching a large population. China and India together have the largest number of population living in the drylands and affected by land problems of desertification. It is estimated that desertification affects about 400 million people directly or indirectly in China and about 300 million in India (Beijing Report, 1997). Desertification has accelerated in countries such as China, Mongolia, India, Islamic Republic of Iran, and some of the countries in Central Asia. Other countries in the region also face a range of land degradation problems such as water and wind erosion, physical and chemical deterioration of soil as result of complex interplay of socio-economic forces and human-induced factors such as deforestation, unsustainable agricultural practices and overgrazing. The extent of desertification in some of the Asian countries is given in Table 2.7.

Table 2.7: Extent of Desertification in Some of the Countries in Asia

COUNTRY	TOTAL SURFACE AREA (in mha)	DEGRADED AREA		Total Population (in millions)	Population Density (No./Sq.km) (in ha)	Cultivated Area per Capita
		(in mha)	%			
China	932	260	27	1150	123	0.08
India*	328	173.6		1012	324	0.18
Kazakhstan	271.1		60	16.9	6.2	2.13
Mongolia	156		41	2.3	1.5	0.16
Turkmenistan	48.8		66.5	4.2	8.6	0.35
Uzbekistan	44.7		59.2	21.7	48.5	0.21
Pakistan	79.6		52	131.6	165	0.16
Syria	18.5		75	14.3	77.3	0.42
Jordan	8.9		96	4.2	48	0.1
Islamic Republic of Iran	163.6		43	67.2	41	0.27

Source: UNCCD, 1998: The Social and Economic Impact of Desertification in Several Asian Countries

* Population Statistics from Census of India 2000-2001 and MOA, 1994.

² UNEP/GRID 1991

The percentages of degraded area in irrigated and rain-fed croplands and rangelands world-wide are lower than those for Asia: 30,47, and 73 respectively

2.3 Challenges Ahead

The FAO has estimated that the world food supply requires to be increased in Asia by 75% over the next 30 years to meet the needs of the growing population. This is particularly challenging because the per capita area of arable land which stood at 0.48 ha in Asia in 1950-1955 is expected to decline to 0.25 ha by 2000. In the Indian context, the per capita area of arable land has declined far more rapidly over the past 30 years and is declining further (Table 2.8).

Table 2.8: Decline in Arable Land in the World, in Asia and in India

Per capita area of arable land	1950-55	1981	1992	2000	2025	Source of Inf.
World	0.32	n.a	0.25	n.a	n.a.	M/o Agriculture,GOI
Asia	0.48	n.a	n.a	0.25	n.a	CCD Report, Beijing1997
India	0.9	0.5	n.a	0.15	0.08	M/o Agriculture,GOI, 1997

n.a - not available

Similarly, the situation in terms of forest resources is also of concern. The per capita availability of forest land in India is one of the lowest in the world with 0.08 ha against 0.5 ha for developing countries and 0.64 ha for the world. Comparison of Indian situation in relation to Asia and in the world context is given in Tables 2.9 and 2.10.

Table 2.9 : Per capita of Forest Land in India , Asia-Pacific Region and in the World, as of 1990 is given below:

Country/Region	Per Capita Availability of Forests (ha)	Per capita (GNP) (US\$)
India	0.08	360
Sri Lanka	0.11	470
Indonesia	0.64	560
Malaysia	1.02	2330
Fiji	1.17	1780
Tropical Asia	0.21	475
Total Asia-Pacific	0.17	602
Total Developing Countries	0.50	763
World	0.67	763

Source: FAO (1995) given in NFAP, MOEF, GOI (1999).

Table 2.10: Status of Forests in India in Relation to World.

Details	India	Tropical Asia	Asia-Pacific	Developing Region	World Countries
Growing stock of wood in natural forests (cu.m /ha)	47	140	125	113	114.0
Biomass in natural forests (t/ha) avail. vol. of growing stock	93	181	171	169	131.0
Per capita (cu.m)	2.85	28.00	18.90	54.90	71.76
Avail. biomass per capita (t)	5.63	36.27	25.76	81.73	82.37

Source: NFAP, MOEF, GOI, 1999

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Chapter 3

India - General Profile, Land Use Classification and Land Use Pattern

Highlights of Chapter 3

India occupying only 2.4 % of the world's geographical area, supports about 16.2% of the world's human population. India also has only 0.5% of the world's grazing area but supports 18% of the world's cattle population. India is endowed with a variety of soils, climate, biodiversity and ecological regions. About 228 mha (69%) of its geographical area (about 328 mha) fall within the dryland (arid, semi-arid and dry sub-humid) as per **Thornthwaite classification**. The Thar Desert lies in the hot arid region of Western Rajasthan and is one of the most densely populated deserts of the world. The country has been classified on the basis of agro-climatic, agro-ecological and agro-meteorological zones for the purpose of planning and implementing various programmes and measures. Agriculture is the major sector of growth of the Indian economy. A large percent of the population is still dependent on agriculture for its sustenance. Of the total cultivated area of 142 mha, major part of agriculture in the country is rainfed, extending to over 97 mha and constituting nearly 68% of the net cultivated area. The Chapter also addresses the various land use patterns and land use changes over 40 years.

3.1 General Topography

India's mainland comprises four broad geographical areas: the Northern Mountains which has the great Himalayas, the vast Indo-Gangetic plains, the Southern (Deccan) Peninsula bounded by the Western and Eastern Ghats, and fourthly, the coastal plains and islands (Census of India, 1991).

(i) Northern Mountains: Corresponding with the Himalayan Zone, alongwith country's northern boundaries including the Jammu and Kashmir (J&K), Himachal Pradesh (H.P.), north-west Uttar Pradesh (U.P.), Sikkim, part of Assam, and the North-Eastern States of Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya. The Himalayas comprise of mountain ranges which form an indomitable physical barrier as the world's biggest and largest mountain range. The Himalayas also contain the cold arid deserts and fertile valleys.

(ii) The Great Plains: Also known as the Indo-Gangetic plain is formed by the basin of three distinct river systems - the Indus, the Ganga and the Brahmaputra. The Plains extend from Rajasthan in the West to Brahmaputra valley in the East. This region covers the entire States of Punjab, Haryana, and the Union Territory of Chandigarh and Delhi and major parts of U.P., Bihar, West Bengal, and parts of Assam. These plains comprise one of the world's greatest stretches of flat and deep alluvium and are among the most densely populated areas of the world (456 persons per sq.km). The desert region, which contains the Great Thar desert, extends from the edge of Rann of Kutch to larger parts of Rajasthan (Western) and lower regions of Punjab and Haryana.

(iii) The Deccan Peninsula: This zone covers the whole of South India which includes the States of Tamil Nadu, Karnataka, Andhra Pradesh and Kerala. The Region also covers the State of Madhya Pradesh, and parts of Bihar, Orissa, Puruliya district of West Bengal. Density of population is 202 persons per km². The

Indo-Gangetic plains and the penninsular plateau are separated by mountain and hill ranges known as the Aravali, Vindhya, Satpura, Ajanta and Maikala ranges.

(iv) The Coastal Plains and Islands: The peninsula is flanked on either side by the Eastern Ghats and the Western Ghats. On either side of the Ghats outward to the sea lies a coastal strip. The western coastal plains lie between the Western Ghats and the Arabian sea in the West, whereas the Eastern Coastal Plains face the Bay of Bengal in the East. This is also a region with very high-density population (349 persons per km²).

Table 3.1: Profile of the Main Physio-Geographic Zones in the Country

Physio-Geographic Zone	Area		Population		No. of districts	Density of Popln.	Urban Centres (No.)	Population (in million) in Urban Centres	Villages (No.)	Population (in million) in villages
	in km ²	in %	in million	in %						
Northern Mountains	322158	10.5	28.04	3.34						
The Great Plains	730955	22.2	333.43	39.4	150	456	1516	74.03	235641	259.4
The Deccan Plateau	1525279	49.76	307.49	36.67	158	202	1785	78.13	266892	29.36
The Coastal Plains & Islands	486635	15.38	169.61	20.23	76	349	1031	58.76	67972	110.84

Source: Census of India, 1991

The country's geographical area of 328 mha covers only 2.4% of the world's total area, on which 16.7% of the world's population and about 18% of the world's livestock population survive. Of the total area of 328 mha, land use statistics are available for roughly 305 mha accounting for 93% of the total land area. Of this, roughly 264 mha of land is available for agriculture, forestry and related purposes. Land use is discussed in greater detail in sub-section 3.8 and 3.9.

3.2 Climate

India is mainly a tropical country but due to great altitudinal variations, almost all climatic conditions from hot deserts to cold deserts exist. There are four seasons: (i) winter (December-February), (ii) summer (March-June), (iii) South-west monsoon season (June-September), and (iv) post monsoon season (October-November). During the post monsoon season, commonly known as winter monsoon, monsoon rains begin over north India and pass over the Bay of Bengal before reaching the Andamans and the South-east coast. However, the south-west or the summer monsoon is the main source of rainfall in the country providing 80% of the precipitation.

3.3 Natural Resources

3.3.1. Land - Soils: India has a wide range of soils, each type being particular of a specific locality. Alluvial and black cotton soils are the two most important soil groups for agricultural production. Alluvial soils cover about 78 mha (about 24%) of the total land and occur in the great Indo-Gangetic Plains, in the valleys of Narmada and Tapti in Madhya Pradesh and the Cauvery in Tamil Nadu. These soils are considered

very good for the production of wheat, rice other cereals, pulses, oil seeds, potato, sugarcane, etc. The black cotton soils cover about 51.8 mha. and are found in the States of Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Rajasthan. These are also considered good for cultivation of cotton, cereals, pulses, oil seeds, citrus fruits, vegetables, etc. In addition, Red soils have been estimated to occur in 51.8 mha and are primarily found in Tamil Nadu, Karnataka, Kerala, Maharashtra, Andhra Pradesh, Madhya Pradesh, Bihar and West Bengal. These are most suited for rice, ragi (millet), tobacco and vegetable cultivation. Laterite and lateritic soils occur in 12.6 mha. These are not considered good for agriculture. The area of desert soils is about 37 mha. These are also not found suitable for agriculture.

3.3.2. WATER

3.3.2.1 Rainfall: India receives annually about 4000 cubic kilometres of water through precipitation. About 80% of the country's annual rainfall is mainly from the South-West monsoon season of June to September, followed by the North-West monsoon in November-December. Most of rainfall is therefore few months in a year, the country remaining dry for almost the rest of the year. Also, the rainfall is highly variable both spatially and in quantity among the 35 meteorological sub-divisions, the country has been divided into (Section 3.8.3). It varies from as low as 100 mm in western Rajasthan to as high as 9000 mm in Meghalaya in the north-east India. Monsoon rainfall is usually torrential in intensity. This results in tremendous run-off resulting in soil erosion (Sharma & Paul, 1999).

3.3.2.2. Water Resources: It is estimated that out of the total precipitation of around 400 million hectares metres in the country, the surface water availability is about 187 million hectares. Of this only about 50% can be put to beneficial use because of topographical and other constraints. Of the country's utilisable water resources of about 1100 cubic kilometres, surface sources, e.g. rivers account for roughly 60% and groundwater sources, e.g., wells account for the remaining 40%.

Surface Waters: The country has been divided into 20 river basins- comprising of 12 major river basins, each having a catchment area exceeding 20,000 sq.km and eight composite river basins (Sharma & Paul, 1999). In addition, other water resources include reservoirs, tanks, ponds and lakes which cover about 7 mha of the surface area of the country. India has 14 major river systems. The rivers may be classified as: (i) Himalayan Rivers, (ii) peninsular rivers, (iii) coastal rivers and, (iv) rivers of inland drainage basin. Because of the uneven precipitation, the availability of renewable freshwater varies enormously in different river basins. The Himalayan rivers are snow-fed and perennial. The peninsular rivers are rainfed and therefore fluctuate in volume. The coastal rivers are short in length with limited catchment areas. The rivers and tributaries of the peninsular and coastal rivers are intermittent and non-perennial in nature. The streams of the inland drainage basins of western Rajasthan are few and with little water holding capacity. Floods and drought affect vast areas of the country. A third of the country is drought-prone. Floods affect an average area of around 9 million hectares per year. According to the National Commission on Floods, the area susceptible to floods is around 40 million hectares.

Groundwater: The groundwater potential varies in different regions of the country. Due to heavy extraction of groundwater and its limited recharge, the groundwater is getting depleted at a fast rate. This depletion is particularly marked in most of the dryland regions of States such as Andhra Pradesh, Karnataka, Rajasthan, Madhya Pradesh, Orissa and Maharashtra.

3.3.3. Forests: Indian forests show greatest variation and range depending upon rainfall, soil topography and climatic factors. The forests range from tropical rainforests to dry thorn forests and mountain -temperate forests. There are four major forest types and 16 detailed forest types in the country (Table 3.2). More than half of the forest area in India is tropical-moist and dry-deciduous types. Forests are both a resource and a habitat for a rich flora and fauna found in the country. Of the 16 forest types in the country, the tropical deciduous form the major forest type of India with 38.2 % of the total forest area. Other predominant forest type is the moist deciduous covering 30.3 % of the forest area of the country.

Box. 3.1. Benefits of Natural Forests	
Benefits of Natural Forests	Soil protection. Soil fertility. Water conservation. Conservation of flora & fauna. Micro-climate Conservation of genetic resources Use of varieties for genetic breeding and biotechnology. Integrated watershed management. Conservation of soil and regeneration of ecosystems as windbreaks and shelterbelts.

Forestry is an important part of land use. Land allocation for forestry includes: (i) areas set apart as forestland, (ii) non-forest land (agroforestry, farm woodlots, windbelts, and shelter belts, avenue trees, urban forests/parks, homestead forests and sacred groves). As per the Forest Resources Assessment of FAO in 1995, the situation of the natural forests of India is as given in Table 3.3 below.

Table 3.3. State of Natural Forests in India

Area of natural forests	:	51.73 mha
Total growing stock in natural forests	:	2431.3 million cu.m
Total biomass in natural forests	:	4805.7 million tonnes

Source: NFAP, MOEF, GOI, 1999

countless non-wood forest products are removed from the forests annually. At a conservative level of pricing (Rs.500 per tonne of fuel/fodder), the value of these commodities is estimated to approximately aggregate to over Rs. 300,000 million per annum (NFAP, MOEF, 1999).

3.3.4. Biodiversity: India is rich in biodiversity because of its diverse physiography and climatic conditions. India falls in the confluence of three major bio-geographic realms - the Indo-Malayan, Eurasian and Afro-Tropical. The country is divided into ten biogeographic zones: (i) Trans-Himalayas, (ii) Himalayas, (iii) Indian Deserts, (iv) Semi-Arid areas, (v) Western Ghats, (vi) Deccan Peninsula, (vii) Gangetic Plain, (viii) North-East India, (ix) Island and (x) Coasts. India is one of the 12 mega biodiversity countries of the world. Out of the 18 unique biodiversity 'hotspots', which contain about 20% of the world's flora, two, namely - north-eastern Himalayas and the Western Ghats are located in India. In order to protect and conserve the biodiversity, a number of 'Protected Areas'- in the form of National Parks and Sanctuaries have been set up. The biogeographic locations of these are given in Table 3.4.

Table 3.2: Major Forest Types Found in India

Forest Type (in mha)	Sub-Type	Area	%	Occurrence in States/Union Territories
Tropical	Tropical Wet Evergreen Forests	4.5	5.8	Arunachal Pradesh, Assam, Karnataka, Kerala, Mizoram, Manipur, Nagaland, Tamil Nadu, Sikkim, Andaman & Nicobar Islands, Goa.
	Semi-Ever-Green Forest	1.9	2.5	Assam, Karnataka, Kerala, Maharashtra, Nagaland, Orissa, Tamil Nadu, Andaman & Nicobar Islands, & Goa.
	Moist Deciduous Forest	23.3	30.3	Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Tripura, Nagaland, Orissa, Tamil Nadu, Uttar Pradesh, West Bengal, Andaman & Nicobar Islands, Goa, Dadra & Nagar Haveli.
	Littoral Swamp Forest	0.7	0.9	Andhra Pradesh, Gujarat, Maharashtra, Orissa, Tamil Nadu, West Bengal, Andaman & Nicobar Islands.
Sub-Tropical	Dry Deciduous Forest	29.4	38.2	Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, J&K, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh.
	Thorn Forest	5.2	6.7	Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh, Karnataka, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh.
	Dry Evergreen Forest	0.1	0.1	Andhra Pradesh, Tamil Nadu.
	Subtropical Broadleaved Hill Forest	0.3	0.4	Assam, Meghalaya.
	Subtropical Pine Forest	3.7	5.0	Arunachal Pradesh, Himachal Pradesh, J&K, Manipur, Meghalaya, Nagaland, Sikkim, Uttar Pradesh, Haryana, Punjab.
	Subtropical Dry Evergreen Forest	0.2	0.2	Himachal Pradesh, J&K.
J&K, Himachal Pradesh	Montane Wet Temperate Forest	1.6	2.0	Arunachal Pradesh, Karnataka, Manipur, Nagaland, Sikkim, Tamil Nadu.
	Himalayan Moist Temperate Forest	2.6	3.4	Himachal Pradesh, J&K, Uttar Pradesh.
	Himalayan Dry Temperate Forest	0.2	0.2	
Alpine	Sub Alpine Forest]		
	Moist Alpine Scrub]3.3	4.3	J&K, Uttar Pradesh.
	Dry Alpine Scrub]		

Source: Forest Survey of India (1995) in NFAP, MOEF, GOI, 1999.

In India, forests meet nearly 40% of the energy needs of the country of which more than 80% goes for energy needs of the rural areas and about 30% of the fodder needs of the cattle population. It is estimated that about 270 million tonnes of fuelwood, 280 million tonnes of fodder, over 12 million cubic metres of timber and

Table 3.4: Bio-geographic Zones of Protected Areas in the country

Bio-geographic Zone	Number of National Parks and Sanctuaries	Area (Sq. km.)	Area of Bio-geographical Zone (%)
Trans-Himalaya	7	17002.5	9.2
Himalayas	67	20890.52	9.92
Deserts	6	16076.08	7.45
Semi-Arid	91	15302.6	2.8
Western Ghats	56	13425.01	10.12
Deccan Peninsula	137	51151.74	3.71
Gangetic Plain	36	7648.92	2.16
Coasts	26	5619.58	6.79
North-East	27	4354.12	2.54
Islands	103	1529.27	18.54
Total	556	153000	

Source: WII, 2000

3.4. Agriculture

Agriculture contributes to 29.93% of India's GDP. The overall growth of the Indian economy has depended much on the performance of agriculture. With a share of 2.7% of the world agricultural production, India is ranked sixth in the world. Major part of agriculture in the country is rainfed, extending to over 87 mha and constituting nearly 61% of the net cultivated area. The wide variation in rainfall and potential evapo- transpiration (PE) decides the actual land use and vegetation cover available. Presently a large percentage area of cultivation growing the coarse cereals (90%), pulses (81%), oil seeds (76%), cotton (65%) and rice (50%) are rainfed. Agriculture also is the single largest source of employment in India, even though its contribution to the national economy has been shrinking over the years (MOA, 1996). In 1990-91, of the total main work force of an estimated 285.42 million, 64.90% constituted the agricultural workforce.

Expansion of irrigation has played an important role in the development of agriculture and of various States. The full irrigation potential of the country has been estimated to be 113.5 mha (revised to 139.5 mha), comprising 58.5 mha from major and medium schemes, 15 mha from minor irrigation schemes and 40 mha (revised to 66 mha) from ground water exploitation. India's irrigation potential has increased from 22.6 mha in 1951 to about 90 mha at the end of 1995-96. Against this the utilisation of irrigation potential at the end of 1995 was 78.5 mha. Though water is a precious and scarce resource, its application and use efficiencies have been low. Most irrigation projects are operating at a low efficiency in the range of 30-40%, thereby losing 60-70% of the irrigation water during conveyance. It is estimated that even after achieving the full irrigation potential, nearly 50% of the total cultivated area will remain rainfed. Of the net canal irrigated area of 17 mha, 3.4 mha are estimated to be under varying degrees of water logging and soil salinity (this is discussed in greater detail under Chapter 5: Sub-Section 5.2, Processes of Desertification).

3.5. Population Demography

3.5.1. Human: The human population estimates¹ as of March 1, 2001 is 1027 million. The annual compound growth for human population is estimated to be 1.93. A matter closely related to the problem of environmental

security in India is the issue of scarcity of natural resources vis-à-vis human carrying capacity. For instance, arid zone standards, drylands of India have a high population density (in fact the Thar Desert in the Indian Arid Zone is considered the one of the densest deserts of the world), and the Great Gangetic Plains has an average of 456 persons per sq.km. The rate of growth of population during the decade 1981-1991 in dryland region has been 29 percent as against 23 percent for the country (MOEF, 1996). The population of India has increased from 16.2 % in 1991 to 16.7% of the world's population in 2001.

Table 3.5: Increase in population from 1951 to 2001 (in million)

	1951	1961	1971	1981	1991	2001 ²
Total	361	439	548	683	846	1027
Rural	298	360		439	525	
Urban	62	79		244	321	

Source: Information upto 1991: Census of India, 1991, for 2001: Provisional Census Report, 2001

Of the total 452 districts in the country as of 1991, 224 districts showed population growth rate higher than the national average of 23.85% as of 1991. Seven districts in Rajasthan showed very high growth rate of 30-35%. The State of Uttar Pradesh is the most populated in the country - 166.0 million population as of 2001 and more than doubled from 1951 (54.59 million).

3.5.2. Livestock

Man and livestock have long had a close association since the early history of mankind. The livestock population in India is one of the highest in the world (Table 3.6):

Year	Total Livestock Population* (in ,000)	Cattle (in ,000)
1977	369,645	180,140
1982	419,742	192,453
1987	445,286	199,695
1992	470,860	204,584

Source: Agricultural Statistics at a Glance, 2001. Directorate of Economics & Statistics, Min. of Agriculture.

* Total Livestock includes cattle , buffaloes, sheep, goats, horses, pigs, donkeys & mules, camels, yaks, 'mithuns'

Over the four decades -1951 to 1992, the years for which livestock census are available, the number of bovine increased substantially viz., 45 per cent. Sheep and goat population were 39 million and 47 million respectively in 1951 and the same grew to 51 and 115 million respectively in 1992. Thereby increasing by 30% to 144% respectively over the period. The annual growth rate (%) during these two periods for bovine, sheep and goats were 0.9, 0.64 and 2.20 respectively. The population estimates for total livestock in 1992 was 470 million.

Livestock population and density in the arid region is very high (Table 3.7). The region also has a number of wild life such as the 'Chinkara', Blackbuck, peacocks and the Great Indian Bustard, which is an endangered bird species.

¹ and ²Census of India, 2001- Provisional Report

Table 3.7: Estimated Population of Livestock in the Hot Arid region.

LIVESTOCK	POPULATION
Camels	1,001,000
Sheep and Goats	155,910,000
Cattle	199,695,000
Horses, Donkeys, & Mules	1,922,000
Yaks	-
Elephants	
Buffaloes	75,677,000
Others	175,000

Source: ICFRE, 1999

3.5.2.2. Income and employment from Livestock

Livestock is an important source of supplementary income of rural households; a nation wide survey of the National Council of Applied Economic Research (NCAER) survey indicated that income from livestock averages 22.5 per cent of total household incomes (MOA, 1996). Livestock in the Indian context, is thus a major instrument for improving rural employment, particularly rural self-employment. In 1991, 65 per cent of the total Indian working force of 185 million people was dependent on agriculture; 80 per cent of these involved in livestock production, either as producers or as workers. The family women carry out some 60 percent of the work related to care and management of live stock in households. The total value of livestock asset in 1993-94 was Rs.669 billion. This has increased to Rs.1302 billion in 1999-2000 as per the latest estimates of National Accounts released by the Central Statistical Organisation. The GDP from livestock sector is around 5-6% over the years and it is 5.5% in 1999-2000 at current prices. The value of output (excluding draught power) Rs.436 billion, at 1996 price level. The draught output was valued at Rs.22 billion on fuel equivalent basis. The livestock sector thus represents amongst the lowest capital/output ratios in the economy while displaying high capacity for labour absorption. The livelihood challenge in the livestock sector is of improving the productivity of and returns to the labour deployed on it (MOA, 1996). Livestock in India is characterised by very large numbers and very low productivity, across all species. Yield of milk per cattle head is poor compared to other countries.

Livestock production in India, is characterised by widely distributed small stock holdings, millions of them, across the length and breadth of the country, stock holding size averaging from two to three animals per holding for bovine, except in the nomadic herds of Gujarat and Rajasthan. For goats too this pattern prevails – holding size increases for goats as part of the nomadic herds in Rajasthan and Gujarat. Sheep are usually held in large flocks and are seldom found in small holdings – the flock size varies from a few heads to several hundreds and are localised in specific areas in the state of Gujarat, Rajasthan, Uttar Pradesh, Tamil Nadu, etc. Rural employment in livestock grew at 4.15 per cent between 1972 and 1982, a growth rate much higher than of agriculture (1.15) and the entire rural sector (1.75). Since the organisation of livestock production has largely maintained unchanged, the employment growth is on account of increased output, growing marketisation, and increased activity level in intermediate processing and value addition.

3.5.2.3. Feed and Fodder for livestock

Livestock production in India is entirely dependent on crop residues and crop by-products. The total supply

of feed and fodder in 1993 was straw 398 million tons, green fodder 573.50 million tons, and concentrates 41.98 million tons (MOEF 1993 estimates). While estimates of feed and fodder, past, current as well as future, portray huge deficits (demand-supply gap), the livestock population increased across all species, 40-300 per cent, and output of the sector tripled or quadrupled, all taking place within the supposedly diminishing feed and fodder supply base. It is difficult to understand how this happens – either, it is unlikely that the deficits are of the magnitude portrayed or all the increase in numbers and incremental production have taken place at the expense of the ecology. However, fodder development continued to remain marginalised even in the Seventh Plan – despite growing concern over the acute scarcity situation. The devastating effect of the two-year stretch of severe drought, almost countrywide during the 1985-87 period focused attention on the need for alternate strategies for feeding the livestock. The Seventh Plan however could not rise above the usual departmental approach of fodder development schemes, mini kits, etc.

About a third of the total feed intake of the ruminants in India, large and small, is by grazing on common property resources (CPRs). Overgrazing by herds far larger than what the land can sustain, year after year, has progressively rendered them marginal or waste lands, grossly eroded - some estimates put annual erosion of top soil at 6000 million tons - reduction in water points 55 to 92 per cent (MOA,1996), and changing plant association, making them unsuitable for bovines and fit only for sheep and goats.

3.6 Socio-Economic Development

Though agriculture has been the main occupation of the bulk of the Indian population, the founding fathers of independent India had visions of the country becoming a prosperous and Modern State and accordingly established a good industrial base. Since then, India has achieved a good measure of self-sufficiency in the manufacture of a wide variety of basic and capital goods. However, even as of today, a large percentage of the population in the country is dependent upon subsistence economy.

However, agricultural sector continued to receive the attention it deserved in the successive Five-Year Plans, which provided momentum to the agricultural production and resilience to the economy. India today is not only self-sufficient in grain production, but also has a substantial reserve, which helps in overcoming the effects of drought and occasional failure of monsoon. In 1998-99, the primary sector comprising agriculture, forestry and logging, fishery, mining and quarrying is estimated to have contributed 29 percent to the Gross Domestic Product (Min. of Finance, 2000) and provide livelihood to about 67.5 percent of the work force in the country (Census of India, 1991).

Rural employment in livestock grew at 4.15 per cent between 1972 and 1982, a growth rate much higher than of agriculture (1.15) and the entire rural sector (1.75). Since the organisation of livestock production has largely maintained unchanged, the employment growth is on account of increased output, growing marketisation, and increased activity level in intermediate processing and value addition.

The statistical profile of the country is summarised in Table 3.8.

Table 3.8: Statistical Profile of India

A. Total Land Area	328.7 mha
Area which is enumerated in the census	306.50 mha
Forests	67.0
Area under non-agricultural use	21.8
Barren and Unculturable Land	19.4
Permanent Pasture and Grazing Lands	12.0
Fallow Lands	24.0
Cropped Area	142.5
- Area under Food Grain Cultivation	123.5
- Of this, Area under Rainfed Farming Systems	89
B. Administrative Divisions (as on March 2001)	
Number of States (includes three newly formed States of Uttaranchal, Chattisgarh and Jharkand)	28
Union Territories	7
City Corporations (Cities of one million or more population) (1991)	18
Other Cities and Municipal Towns (approx.) (1991)	4,500
No. of Districts (as on 2001)	593
Villages (approx.) (1991)	600,000
C. Human Population (2001 Census) Provisional Report	
Total Population (in millions)	1027 (as against 846 in 1990-91)
Rural Population (in millions)	
Population (annual exponential) growth rate (in %)	1.93 (as against 2.14 in 1990-91)
Decadal Growth (1991-2001) (in %)	21.3 (as against 23.85 in 1999-91)
Average Population Density (per square km)	324 (as against 267 in 1990-91)
D. Livestock Population (in thousands) (as in 1992)	470, 860
E. GDP Total	Rs 7,161,110 million
Of this: (in %)	
Agriculture	29.93
Of this, forestry (incl. Under Agriculture)	1.25
Mining & Quarrying	2.37
Manufacturing	17.07
Trade, Hotels, etc.	12.84
Construction	5.56
Electricity, gas, etc.	2.79
Transportation	8.03
Financial Services	8.35
Social/Personal services	11.77
NNP per capita	
One US\$ = Rs. 46.56 (as on 1 st March 2001)	
F. Social Indicators	
Life Expectancy (in years, 1998)	62.9
Adult Literacy (in % above 15 (2001)	65.3
Population below poverty line (1999)	19%
Infant Mortality Rate (per 1000 births, 1999)	70
Sex Ratio ((No. Females per 1000 males) (2001)	933
G. India in Relation to the World (% of Total)	
Area	2.4%
Forest Area	1.8%
Grazing Land	0.5%
Human Population (as on March 2001)	16.7
Cattle Population	18.0

Source of Inf: (i) GOI: Directorate of Economics and Statistics (1996) Agricultural Statistics at a Glance, (ii) World Bank (1996), (iii) India: Country Economic Memorandum, (iv) Census of India, 1991, (v) Provisional Census Report, 2001, (vi) UNDP Human Development Report, 2001, (vii) NFAP, 1999 and (viii) Census of India, 2001.

3.7 Land Use Classification

India has a diverse agro-climate, topography and soil types on the basis of which it has been categorised into various regions. Major part of the country is rainfed. Rainfall, therefore, constitutes an important parameter in the classification of the country into various regions for the purpose of planning.

3.7.1 Agro-Climatic Regions: India has been divided into 15 agro-climatic zones on the basis of climate, in combination with soil and other factors that affect the agriculture in the region. This classification originated in 1979 by the Indian Council of Agricultural Research (ICAR) through the National Agricultural Research Project (NARP). These are:

1. Western Himalayan Region.
2. Eastern Himalayan Region.
3. Lower Gangetic Plains Region.
4. Middle Gangetic Plains Region.
5. Upper Gangetic Plain Region.
6. Trans Gangetic Plains Region.
7. Eastern Plateau and Hill Region.
8. Central Plateau and Hill Region.
9. Western Plateau and Hill Region.
10. Southern Plateau and Hill Region.
11. East Coast Plains and Hill Region.
12. West Coast Plains and Ghat Region.
13. Gujarat Plains and Ghat Region.
14. Western Dry Region.
15. Island Region.

3.7.2 AGRO-ECOLOGICAL REGIONS (AERs) AND SUB-REGIONS (AESRs)

Agro-Ecological Regions: The country has also been categorised into 20 Agro-Ecological Regions on a 1:4 million scale map, based on physiography, soils, climate, growing period and also taking into account available water capacity of the soil, etc. The mapping and classification of the various parts of the country for generation of agro-ecological regions involved the superimposition of four base maps, namely physiography, soils, bioclimate and length of growing period and have been used for resource planning at national level.

Agro-Ecological Sub-Regions (AESRs): The agro-ecological regions (see section 3.8.2) were subsequently refined to prepare a 60 Agro-Ecological Sub-Regions (AESR) Map for regional level planning using the detailed soil information at subgroup level, physiography at land form level, and bioclimate (refined limits of arid, semi-arid and sub-humid bioclimate) (Annex, 3.) types and length of growing period (LGP) at 30 day class interval. The AESR map is useful for regional level planning and resource allocation. The information of length of growing period as well as agro-ecological zoning supported by moisture availability index can act as an excellent base for crop modelling and crop suitability evaluation.

3.7.3. Bio-Climatic Regions

The agro-ecological regions fall into 6 major climatic regions as given below:

- (i) **Arid**
- (ii) **Semi-arid**
- (iii) **Dry Sub-humid**
- (iv) **Moist Sub-humid**
- (v) **Humid**
- (vi) **Per-humid**

Based on the classification laid down by the National Bureau of Soil Science and Land Use Planning (NBS&LUP) in the publication “Agro-Ecological Sub-regions of India for Planning and Development” (Velayutham 1999) and the Method of the dryland classification of bioclimatic zonation of the country, main areas/districts in the concerned regions falling in the various bioclimatic regions are given in Annex-3. **It is important to note that the Thornthwaite system of classification is used for agricultural planning in the country considering the annual rainfall, moisture index and other aspects such as the growing period of crops.**

DRYLAND (ARID-SEMI ARID- DRY SUB-HUMID) REGIONS OF INDIA

According to NABBLUP, Nagpur the arid, semi-arid and dry sub-humid regions constituting the ‘drylands’ (as per Thornthwaite Classification) cover about 228.3 mha (69.6%) of the total land area (328 mha) of the country (Table.3.9). A large number of States fall within the drylands. However, almost the entire North-Eastern Region covering the States of Assam, Meghalaya, Nagaland, Tripura, Manipur, Mizoram, Sikkim and Arunachal Pradesh), and the State of Uttaranchal in North India do not fall within the dryland region. In addition, parts of Jammu & Kashmir, parts of Himachal Pradesh, coastal areas of Karnataka, Maharashtra, Goa, and major parts of the States of Kerala, Orissa, West Bengal and the Islands of Andaman & Nicobar and Lakshwadeep and Minicoy, which are predominantly humid/perhumid also do not fall within the dryland regions. It is however important to note that land degradation is a serious problem even in the humid/per-humid regions of the country, particularly in the hilly regions, where the main process of land degradation is water erosion resulting in high losses of top soil and fertility. Major part of the dryland regions in the country are rainfed, while some are irrigated. **The country’s programmes are therefore, not targeted to addressing land degradation in the drylands alone, although special emphasis is given to rainfed regions.**

(I) ARID REGION: According to NBSSLUP, about 50.8 mha (15.8%) of the country’s geographical area is arid (Table 3.8).

HOT ARID REGION: These include the hot arid regions that occupy major parts of Rajasthan (Western), Gujarat, southern parts of Punjab and Haryana and a small portion of Deccan Penninsula in the States of Andhra Pradesh, Karnataka, Maharashtra. Roughly, three-fourths of the State of Rajasthan, comprising of 12 western districts falls within the hot arid zone. These are the districts of: Barmar, Bikaner, Churu, Sri Ganganagar, Hanumangarh, Jaisalmer, Jalore, Jhunjunu, Jodhpur, Nagaur, Pali and Sikar (Faroda, A..S, 1999).

Table 3.9: Classification of 'dryland' regions in India using Thornthwaite Classification

S.N.	REGION	ANNUAL AV. RAINFALL (in mm)	MOISTURE INDEX (As per Thornthwaite Classification)	GROWING PERIOD (in days)	TOTAL LAND AREA	
					in mha	in %
1.	Glaciers & Others	-	-	-	5.2	1.5
2.	Hyper Arid	<100	<-83.3	0-60	22.9	7.0
3.	Typic Arid	100-500	-66.7 to -83.2	60-90	22.7	7.0
4.	Semi-Arid (dry)	500-750	-50 to -66.6	90-120	51.2	15.6
5.	Semi-Arid (moist)	750-850	-49.9 to -33.4	120-150	72.2	22.0
6.	Sub-humid (dry)	850-1000	-33.3 to 0	150-180	54.1	16.5
7.	Sub-humid (moist)	1000-1500	0 to 20	180-270	39.8	12.1
8.	Dry/Moist Sub-humid transition	1000-1500	0 to 20	210-270	21.0	6.4
9.	Humid		21 to 99.9	210-330	16.6	5.1
10.	Perhumid	>2500	>100	>300	20.5	6.3
11.	Transition Humid/Per humid	-do-	>100	-do-	1.8	0.5
12.	TOTAL				327.9	

The area of bio-climatic regions 1-6, which fall under the dryland regions (as per Thornthwaite Classification) = 228.3 mha

Source: National Bureau of Soil Survey and Landuse Planning (NBSSLUP), 2001.

The hot arid region suffers low and erratic rainfall, frequent droughts, high evaporation, intense heat and high winds. The soils are not conducive to intensive crop production. The human population in the Indian arid zone is high, a part of which is nomadic maintaining a high livestock population. The density of both human and livestock population is high as compared to national average, which has put the scarce natural resources under severe stress. There are a number of tribes such as the *Gujjars, Bakarwals, Gaddis, Rathis, Banjaras, Raikars and 'Rabaris'* which are nomadic and follow a pastoral systems of living. The nomadic lifestyle has over the years being replaced by agrarian in regions not suitable for arable cropping systems, which has further degraded the fragile ecosystem. In arid areas the growing season being very short millets and short duration pulses dominate the cropping systems. Livestock farming forms an integral part of this ecosystem.

THE GREAT INDIAN THAR DESERT

The Great Indian Desert also known as the 'Thar' Desert, lies in Western Rajasthan and comprises of an area of 196,150 sq.km. (Table 3.10).

COLD ARID REGION: In addition, an area of about 15.2 mha of cold desert are located in Jammu and Kashmir and the Lahul-Spiti region in Himachal Pradesh.

Table 3.10: General Information on Thar Desert

Population engaged in (in million)	1980	1990	
Agriculture	13.48		17.50
Animal Husbandry	2.84		3.20
Household Industries	0.13		0.15
Landuse in the 'Thar' Desert			
Area in km ²	1980	1990	1993
Desert Area of no or minimal value			4270
Area in danger of desertification			134300
Cultivated area	128300	131670	123378
Pastureland	59760	53800	52284
Others	2840	3880	4285

Source: Report of MEA submitted to the CSD in 1995.

(II) SEMI-ARID

About 123.4 mha (37.6%) of the country's geographical area consists of the semi-arid region. (NBSSLUP, 2001). The semiarid tropical areas (SAT) can be further classified into dry and wet. In the SAT, the crops and cropping systems are quite diverse depending on the soil type and the length of growing season. Sorghum, cotton, soyabean, groundnut and pulses are the major crops grown in this zone.

(III) DRY SUB-HUMID

About 54.1 mha (16.5%) of the country's geographical area falls within the dry sub-humid region. The dry sub-humid region receives fairly high rainfall providing ample opportunities for water harvesting. This can be effectively integrated with the safe disposal of excess runoff to overcome water congestion of soils for crops (other than rice). Rainfed rice is the predominant crop followed by pulses, oilseeds and to some extent, vegetables. Fruit crops particularly in Orissa are also an important component of the production system.

3.7.4 AGRO-METEOROLOGICAL REGIONS

The country has also been classified into 35 agro-meteorological divisions for the purpose of monitoring rainfall intensity and drought. These are given in Table.3.11 below: The concept of drought on a sub-divisional/district scale is presently under review.

3.8 Land Use Pattern in India

The pattern of land use of a country at any particular time is determined by the physical, economic and institutional framework taken together. In other words, the existing land-use pattern in different regions in India has been evolved as a result of the action and interaction of various factors, such as the physical characteristics of land, the institutional framework, the structure of other resources (capital, labour etc.) available, and the location of the region in relation to other aspects of economic development e.g. those relating to transport as well as to industry and trade. The present pattern can, therefore, be considered in some sort of static harmony and adjustment with the other main characteristics of the economy of the region. A close study of the present land-use pattern and the trends during recent years will help to suggest the scope for planned shifts in the pattern.

Table 3.11: Agro-Meteorological Regions of the Country

1	Andaman & Nicobar	21	Gujarat Region
2	Arunachal Pradesh	22	Saurashtra & Kutch
3	Assam & Meghalaya	23	Konkan & Goa
4	Nagaland, Mizoram & Tripura	24	Madhya Maharashtra
5	South West Bengal	25	Marathwada
6	Gangetic West Bengal	26	Vidarbha
7	Orissa	27	Coastal Andhra Pradesh
8	Bihar Plateau	28	Telangana
9	Bihar Plains	29	Rayalaseema
10	East Uttar Pradesh	30	Tamil Nadu & Pondicherry
11	Plains of West U.P.	31	Coastal Karnataka
12	Hills of West U.P.	32	North Karnataka
13	Haryana, Delhi & Chandigarh	33	South Karnataka
14	Punjab	34	Kerala
15	Himachal Pradesh	35	Lakshadweep
16	Jammu & Kashmir		
17	West Rajasthan		
18	East Rajasthan		
19	West Madhya Pradesh		
20	East Madhya Pradesh		

Source: India Meteorological Department (IMD)

3.8.1 CLASSIFICATION OF LAND USE

Out of the total geographical area of 328.73 million hectares, land use statistics are available for roughly 305 million hectares, contributing 93 per cent of the total. Till 1949-50, the land area in India was classified into five categories known as the five-fold land-utilisation classification. This five fold land utilisation classification was however, a very broad outline of land-use in the country and was not found adequate enough to meet the needs of agricultural planning in the country. The states were also finding it difficult to present comparable data according to this classification, owing to the lack of uniformity in the definition and scope of classification covered by these five broad categories. To remove the non-comparability and to break up the broad categories into smaller constituents for better comprehension, the Technical Committee on Co-ordination of Agricultural Statistics, set up by the Ministry of Food and Agriculture, recommended a nine-fold land-use classification replacing the old five-fold classification. Based on the nine-fold classification, the all-India data on land utilisation pattern since 1950-51, is given in Table 3.13. The State-wise pattern of land utilisation as in 1990-91 is given in Table 3.14.

3.8.2 Area under Agricultural uses

The states of Haryana, Punjab, West Bengal, Maharashtra, Uttar Pradesh, Kerala, Karnataka, Gujarat, Bihar, Pondicherry, Delhi and Union Territories of Laccadive, Minicoy and Amindive Islands (Lakshadweep), cultivate more than 45 per cent of their reporting area. In some of the states like Haryana and Punjab, which lie in the fertile Indo-Gangetic plains of India, the net area shown is between 60 and 70 per cent of the corresponding reporting area. Maharashtra has the highest net area sown in the country. The states of

Maharashtra, Madhya Pradesh, Karnataka, Gujarat and Bihar account for more than three-fourths of the country's net area sown.

3.8.3 Land under non-agricultural uses

This category includes all lands occupied by buildings, roads and railways, or under water, e.g. rivers and canals, and other lands put to uses other than agricultural. During recent years, there has been an increase in the area put to non-agricultural uses, as expected, because as a result of increase in the developmental activities, more and more land is being used for industrial sites, housing, transport systems, recreational purposes, irrigation systems etc. The states where the proportion of land under non-agricultural uses is higher than the all-India average are Haryana, Jammu & Kashmir, Kerala, Orissa, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Assam, Goa, Delhi, Pondicherry and the Union Territory of Daman and Diu. The states which account for more than two-thirds of the land under non-agricultural uses are Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Bihar, Tamil Nadu, Rajasthan, Orissa and Karnataka.

The other types of areas, which are covered under barren and unculturable lands, are generally unsuitable for agricultural use either because of the topography or because of their inaccessibility. Instances are the desert areas in Rajasthan, the saline lands in parts of the Rann of Kutch in Gujarat, the weed infected and ravine lands in Madhya Pradesh and alkaline lands in Uttar Pradesh. The proportions of barren and uncultivated lands to the reporting areas are higher in the states of Rajasthan, West Bengal, Assam, Gujarat, Manipur, Nagaland, Meghalaya, Arunachal Pradesh and Mizoram. The states of Rajasthan, Gujarat, Uttar Pradesh, Madhya Pradesh, Meghalaya, Assam and Maharashtra together account for more than 67 per cent of the land under this category in the country.

3.8.4 Area under Forests

The recorded forest area of the country is 76.52 mha as reported by the State Forest Departments (FSI, 1999). This area has been classified into Reserved, Protected and Unclassed forest, which constitute 54.44, 29.18 and 16.38% of the forest area respectively. As per data from remote sensing on the basis of data and the FSI assessments, only 63.73 mha is estimated to be under actual forest cover as of 1999. The discrepancy is basically due to differences in methods of data collection, legal records and ground truthing. Any plantation which is less than 20 ha block cannot be interpreted by satellite imagery as per existing technology.

Box 3.2 Classification of Recorded Forest Area	
Reserved Forest	An area notified under the provisions of Indian Forest Act having full degree of protection. In reserved forest, all activities are prohibited unless permitted.
Protected Forest	An area notified under the provisions of the Indian Forest Acts having limited degree of protection. In protected forests, all activities are permitted unless prohibited.
Unclassed Forest	An area recorded as forest but not included in reserved or protected forest category. Ownership status of such forests varies from state to State.

Table 3.12. Forest Area Statistics

CLASS	Area in Sq.Km	Percentage of Geographical Area
Dense Forest	377,358	11.48
Open Forest	255,064	7.76
Mangrove	4,871	0.15
Total	637,293	19.39

Source: State of Forest Report, FSI, 1999

The ownership of forest rests mainly with the Government. However, in the North-Eastern States, the communities and clans also own significant areas of unclassified forests. Forests in India have been shrinking for several decades owing to pressures of population on land for competing uses such as agriculture, industry, roads etc. That forests are inadequate in India is evident from the fact that the prevailing forest area available per capita is only 0.08 hectares, whereas at current levels of consumption of forest produce and productivity of forests, it is estimated that each Indian would require at least 0.47 hectares of forest to meet his basic needs (SOE, 1995). The potential areas for expansion of forest cover are culturable wastelands covering 13.94 mha and part of fallow land and land other than current fallows, covering 9.89 mha (FSI, 1999).

3.8.5 Area under Grazing

The other uncultivated land, excluding current fallows, covers areas classified under permanent pastures and grazing lands, the areas under miscellaneous tree crops and groves and culturable wasteland. About 11.8 mha of land in the country is recorded as permanent pastures and grazing land (Table 3.12). These lands are in community use. The states which have considerable proportions of areas under permanent pastures and grazing lands are Himachal Pradesh, Karnataka, Madhya Pradesh, Gujarat, Rajasthan, Tripura and the Union Territory of Dadra and Nagar Haveli. Madhya Pradesh accounts for a large percentage of land under pastures and grazing lands. About one-third of the country's land under miscellaneous tree crops and groves lies in Uttar Pradesh. The states of West Bengal, Orissa, Andhra Pradesh, Karnataka and Tamil Nadu also have sizeable areas under this category. The states with substantial proportions of areas under cultivable wastelands are Rajasthan, Orissa, Goa and the Union Territory of Daman and Diu. The states of Rajasthan, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, and Orissa together account for more than three fourths of the nation's land resources under this category.

3.8.6 Area classified under Common Property Resources (CPRs)

There are no official estimates of CPRs in India. The CPRs provide basic need and services to vulnerable sections of the rural poor. For instance, they provide resources such as village forests, grazing lands, rivulets, and watershed drainage, and help farmers through crisis periods. It is important to note that a distinction be made between Common Property Resource (CPR) and wasteland. While CPR is a matter of defining a particular type of property rights on land in the class of variety of property rights, the latter is a case of identifying a specific ecological characteristic for making developmental programme for recovery of degraded lands, irrespective of property rights.

Property : State : Owned by Govt., forests or national park.
Private : Private lands, wells within private lands, crop lands
Common Property : Community property where individuals have claims on collective goods as members of recognised community, village, and panchayats. In all CPRs, no single individual has exclusive property rights. Example, community grazing and pasture lands, community wells, and other water sources such as ponds, tanks, etc.

Velayutham (2000) has shown that area of CPRs has come down from 1950-51 to 1997, whereas livestock population during the same period has increased from 292 million to 467 million thereby further increasing the grazing pressure and consequent land degradation. Overgrazing by herds far larger than what the land can sustain, year after, has progressively rendered most CPRs into marginal or wastelands, grossly eroded making them unsuitable for bovines and fit for only sheep or goats.

Table 3.13: Land Utilisation Trend in India

Classification	1950-51	1960-61	1970-71	1980-81	1985-86	1990-91	1997-98 (in %)
1. Geographical area	328.73	328.73	328.73	328.73	328.73	328.73	328.73
2. Reporting area	284.32	298.46	303.76	304.15	304.66	304.87	304.92 (100.0)
(i) Forests	40.48	54.05	63.91	67.47	67.04	68.00	68.86 (22.6)
(ii) Not available for cultivation (a+b)	47.52	50.75	44.64	39.62	40.71	40.90	41.56 (13.63)
(a) Non-agricultural uses	9.36	14.84	16.48	19.66	20.54	21.20	22.53 (7.4)
(b) Barren and uncultivable	38.16	35.91	28.16	19.96	20.17	19.70	19.03 (6.2)
(iii) Other cultivated land (excluding fallow land) (a+b+c)	49.45	37.64	35.06	32.31	31.11	30.50	28.36
(a) Permanent pastures and other grazing land	6.68	13.97	13.26	11.97	11.97	11.80	10.91 (3.6)
(b) Miscellaneous tree crops and groves	19.83	4.46	4.30	3.60	3.45	3.70	3.57 (1.2)
(c) Cultivable wasteland	22.94	19.21	17.50	16.74	15.69	15.00	13.88 (4.57)
(iv) Fallow land (a+b)	28.12	22.82	19.88	24.75	24.88	23.40	24.12
(a) Fallow land other than current fallows	17.44	11.18	8.76	9.92	10.02	9.60	9.76 (3.2)
(b) Current fallows	10.68	11.64	11.12	14.83	14.86	13.80	14.36 (4.7)
(v) Net area sown (vi-iii)	118.75	133.20	140.27	140.00	140.92	142.20	142.02 (46.6)
(vi) Gross cropped area	131.89	152.77	165.79	172.63	178.83	185.50	190.76
(vii) Area sown more than once	13.14	19.57	25.52	32.63	37.91	41.62	48.74
(viii) Net irrigated area	20.85	24.66	31.10	38.72	42.08	45.14	54.57
(ix) Gross irrigated area	22.56	27.98	38.19	49.78	54.65	59.64	72.78

Source : Agricultural statistics at a glance, 2001- Directorate of Economics & Statistics, Ministry of Agriculture, GOI.

Table 3.14: Pattern of land utilisation - State-wise - 1990-91 (000 hectares)

State/Union Territory	Total Reported Area	Forest Area	Area not available for cultivation	Permanent pastures and Other grazing lands	Land under misc. tree crops	Cultivable waste land
Andhra Pradesh	27440	5836	4529	881	264	864
Arunachal Pradesh	5486	5150	55	-	35	47
Assam	7852	1984	2455	184	247	104
Bihar	17329	2923	3012	146	255	396
Gujarat	18825	1882	3785	847	4	1955
Goa	361	105	33	1	1	99
Haryana	4391	169	391	28	1	23
Himachal Pradesh	3325	923	393	1202	40	128
Jammu & Kashmir	4505	2747	584	125	75	149
Karnataka	19050	3061	1963	1156	351	461
Kerala	3885	1081	345	4	47	129
Madhya Pradesh	44210	14003	4603	2785	142	1687
Maharashtra	30758	5350	2790	1548	179	1023
Manipur	2211	602	1445	e	24	e
Meghalaya	2249	812	316	17	145	454
Mizoram	2102	1303	211	4	3	74
Nagaland	1698	863	28	-	186	96
Orissa	15540	5574	1173	711	719	463
Punjab	5033	220	519	3	1	40
Rajasthan	34234	2248	4458	1824	26	5777
Sikkim	710	257	270	69	5	1
Tamil Nadu	12994	2091	2348	138	186	299
Tripura	1049	606	130	e	51	2
Uttar Pradesh	29830	5133	3489	351	541	1104
West Bengal	8846	1091	1631	7	57	176
A & N Islands	790	694	17	5	26	9
Chandigarh	11	1	8	-	-	a
D & N Haveli	49	20	3	1	-	a
Delhi	148	2	68	11	10	
Daman & Diu	10	-	3	-	a	4
Lakshadweep	3	-	a	-	2	2

Source : Agricultural Statistics at a Glance (1993). Directorate of Economic and Statistics, Ministry of Agriculture.

Chapter 4

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Chapter 4

Desertification Monitoring and Assessment and Drought Early Warning

Highlights of Chapter 4

Land degradation monitoring and assessments of the entire country are being carried out by a number of organisations in the country. These have helped understand the extent, nature and severity of land degradation in the country. There are large variations in these estimates due to the methodologies used. Estimates of degraded lands made by these agencies vary considerably, e.g., 53.28 m ha to 184.9 m ha. These wide variations in estimates of degraded lands are due to different approaches in defining degraded lands or guess estimates arrived through discussion with limited fieldwork using manual methods and/or adopting various criteria for their delineation. One of the assessments, which is in use is that of the Department of Agriculture and Co-operation, Ministry of Agriculture which indicates that nearly half (about 173 mha) of the country's geographical area (328 mha) is under land degradation of some form or other. Drought is a regular occurrence in some regions of the country. A number of organisations are also involved in drought monitoring and drought early warning. The details of early warning systems that are in use are explained in brief.

4.1 Need for Soil and Land Degradation Information

The natural resources of a country are of primary importance for the sustainability of the ecosystem, conservation of natural resources and for optimal productivity of the land. Soils are highly vulnerable to degradation and nature takes a long time (300-1000 years) to form an inch of the topsoil mainly due to combined effects of climate, vegetation, organisms, relief and type on the rocks and other parent materials (ICAR, 1999). Soils perform many functions such as biomass production, a habitat and green reservoir, and as one of the functional units for ecosystems. Life supporting system on land depends primarily on health and purity of soils to produce biomass and to absorb and decompose toxins. Impairment in any function of soils reduces their quality, value and capacity to provide the basic necessities to support ecosystems. Hence, comprehensive information on soil resources in terms of types of soils, their spatial distribution, and for addressing the processes of degradation and various issues relating to soil conservation such as rainfed farming, soil conservation in catchment areas, command area development, watershed management, etc (MOA, 1999). Therefore management of soil resources is essential for both continued agricultural productivity and protection for the environment. Lack of adequate information on soil resources and improper landuse planning has resulted in many of the present problems of land degradation and desertification.

4.1.1 Surveys on Land Degradation

Soil survey and desertification monitoring and assessments are being carried out by central and state level organisations (Table 4.1).

Table 4.1: Organisations Involved in Soil and Land Use Survey and Mapping

S.N.	Central Level Organisations Include:		
1.	All India Soil and Land Use Survey (AISLUS)	-	Department of Agriculture & Co-operation, Ministry of Agriculture.
2.	National Bureau of Soil Survey and Land Use Planning (NBSS&LUP)	-	Indian Council of Agricultural Research (ICAR)
3.	Central Arid Zone Research Institute (CAZRI) (Arid zone mapping)	-	ICAR
4.	National Remote Sensing Agency (NRSA)	-	Department of Space (DOS)
5.	RRSSC	-	Department of Space
6.	Space Applications Centre (SAC)	-	DOS
7.	National Atlas and Thematic Organisation (NATMO)		
<u>State Level Organisations</u>			
1.	State Departments of Agriculture		
2.	Soil Survey Units		
3.	Agricultural Universities		
4.	Remote Sensing Application Centres		

Source: DAC, MOA, 1999

4.1.2 Scale and Level of Mapping

Soil maps are prepared on different scales from very small (1:1 million) to very large (1: 4000) to meet the requirements of planning at various levels. Small scale maps are needed for macro-level planning at the national level for planning developmental programmes at the national scale. Mapping at a scale of 1:250,000 scale are done at the State/regional levels. Maps of 1: 50,000 scale are useful for district levels planning. Soil maps at 1:8000 or larger scales are required for micro level planning for specific purposes such as soil conservation, reclamation, soil fertility studies, revenue taxation, crop suitability. etc. The scale and utility of mapping is summarised in Table 4.2

Table 4.2: Soil Resource Maps Used for Various Purposes

S.N	Information Required	Scale
1.	National level	1:1,000,000
2.	State level	1: 250,000
3.	District level	1: 50,000
4.	Command Areas and Pre-irrigation Survey	1: 4,000 – 1: 8,000
5.	Farm-level / Micro-watershed	1: 4,000 – 1: 8,000
6.	Soil Conservation Planning /Implementation	1: 4,000 - 1: 8,000
7.	Reclamation of Salt-affected soils	1: 4,000 – 1: 8,000
8.	Optimum Landuse Planning - at	
	District Level,	1: 50,000
	Village Level.	1: 4,000 – 1: 8,000

Source: DAC, MOA

4.1.3 Land Degradation Assessments under Various Surveys

A number of surveys and assessments have been carried out by different agencies over the past several decades on the extent and type of land degradation occurring in the country. The major surveys/estimates are summarised in Table 4.3.

Table 4.3: Major Surveys/Estimates of Degraded Lands

S.N.	Agency/ Organisation	Year	Extent (in m ha)	Criteria for delineation
1.	National Commission on Agriculture (NCA)	1976	175.00	Based on secondary data only.
2.	Ministry of Agriculture, GOI,	1985	173.64	Based on the land degradation statistics for the States
3.	National Bureau of Soil Survey and Land Use Planning (NBSSLUP)	1994	187.7	Mapping on 1:4.4 million scale based on Global Assessment of Soil Degradation (GLASOD) guidelines
4.	Ministry of Agriculture, Dept. of Agriculture & Cooperation	1994	107.43	Based on the land degradation statistics for the States

Source: Compiled from Velayutham, 1999 and DAC, 1999.

The estimates of degraded lands made by these agencies vary considerably. These wide variations in estimates of degraded lands are due to different approaches in defining degraded lands or guess estimates arrived through discussion with limited fieldwork using manual methods and/or adopting various criteria for their delineation. The causes for the discrepancies in the area under degraded lands as reported by the various agencies are:

- Some organisations based their statistics only on estimates and not on mapping.
- The objectives and scales of mapping by various organisations were different.
- Definition, criteria and mapping legend followed by different organisations are different which were designed to meet their specific requirements.
- The base data used for mapping and the date of the base data collection are not consistent for the various cases where the statistics have been generated by various agencies.

4.1.4 Use of Remote Sensing in Desertification Monitoring & Assessment

For taking suitable remedial measures such as reclamation of degraded land, and proper utilisation of wastelands for productive purposes, it is necessary to obtain timely and accurate information regarding the location and extent of wastelands. In 1985, the National Wastelands Development Board (NWDB) commissioned the National Remote Sensing Agency (NRSA) to prepare a wasteland map of the country, as well as for each State. The National Wastelands Identification Project was taken up in 1986 in technical collaboration with the Department of Space and Survey of India. A total of 146 districts showing more than 15% of their area as wastelands, was selected. These maps prepared on a scale of 1:1 million for the States and 1:3.5 million for the whole country. Tehsil maps and census maps were used to transfer the village level on a scale of 1: 50,000, where 1 cm on the map corresponded to 500 metres on the ground. Subsequently, in 1991, it was decided to take up additional districts, having wastelands in the range of 5-15% for mapping. Thus a total of 241 districts were covered for mapping of wastelands. In 2000, an update of the extent of the wastelands in the country was done through NRSA. The comparative estimates of wastelands from 1986 to 2000 is given in Table 4.4.

Table 4.4: Estimation of Wastelands in the Country

S.N	Agency	Year of Assessment	Total area (In mha)	Criteria for estimation
1.	NRSA	1986	53.28	Mapping on a 1:1 million scale based on satellite imagery
2.	NRSA	2000	63.9	Mapping on 1: 50,000 scale. Thirteen categories of wastelands delineated.

Box. 4.1 Use of Remote Sensing in Natural Resource Management (NRM)

- Sustainable Land Management.
- Desertification Monitoring & Assessment.
- Watershed Management.
- Natural Disaster Management.
- Drought Early Warning, Preparedness and Management.
- Monitoring and Mapping of Degraded Lands.
- Landuse/Land cover Changes.
- Management of Water Resources.

Source: NRSA, 1999

4.1.5 Assessment of Forest Cover in the Country

The Forest Survey of India (FSI) is the main agency for assessing the forest cover of the country. The State of the Forest Report FSI is brought out on assessments carried out biennially since 1987. The comparative figure of actual area under forest cover as per these assessments is given in Table 4.5.

Table 4.5: Forest Cover Estimate of FSI (in sq.km)

Year	Forest Cover Estimate	Percentage of Total Area of Country
1987	640,819	19.49
1989	638,804	19.43
1991	639,363	19.45
1993	639,386	19.45
1995	639,876	19.43
1997	633,397	19.27
1999	637,293	19.39

Source: MOEF, 2000

Table 4.6: Forest Area Statistics as per Assessment in 1999

CLASS	Area in Sq.Km	Percentage of Geographical Area
Dense Forest	377,358	11.48
Open Forest	255,064	7.76
Mangrove	4,871	0.15
Total	637,293	19.39

Source: State of Forest Report, FSI, 1999

The FSI is also engaged in preparing thematic map on a scale of 1: 50,000 by interpretation of aerial photographs. These maps depict the forest types, species composition, crown density of forest cover, and other land use. Every year about 5000 aerial photographs corresponding to 260 topographical sheets (on a scale of 1: 50,000) of the Survey of India have been interpreted. Keeping in view the problems associated and relatively older data available in the aerial photos, this activity is being phased out. One work station is being provided to each zonal office which in turn will use satellite data of high resolution (IRS 1C/ID-PAN data) to prepare updated thematic maps with intensive ground truthing and support State Departments in preparation of Working Plans (MOEF, Annual Report, 1999-2000).

4.1.6 Type and Extent of Land Degradation in the Country

In the Indian context, as per the assessment made by the Ministry of Agriculture in 1985, of the total geographical area of about 329 mha, approximately 173.6 mha (53%) are subject to moderate to severe form of degradation. for planning, implementation and monitoring of programmes. The extent and type of land degradation is given in Table 4.7.

Table 4.7: Estimation of Land Degradation Status in India (in mha)

S.N.	Types of Land Degradation	<i>in mha</i>	<i>in %</i>
1.	Water Erosion	107.12	61.7
2.	Wind Erosion	17.79	10.24
3.	Ravines	3.97	2.28
4.	Salt Affected	7.61	4.38
5.	Waterlogging	8.52	4.90
6.	Mines & Quarry Wastes	—	—
7.	Degraded Land due to Shifting Cultivation	4.91	2.82
8.	Degraded Forest Lands	19.49	11.22
9.	Special Problems	2.73	1.57
	Coastal sandy areas	1.46	0.84
TOTAL		173.64	100.0

Source MOA, 1985

The processes and impacts of land degradation occurring in the country are given in detail in the Chapter 5: Factors, Processes & Impacts of Desertification. Degraded areas as well as areas susceptible to degradation processes require attention.

4.1.7 Extent of Desertification in the 'Dryland' Regions of the Country

Dr.H.P.Singh, Director, Central Research Institute for Dryland Agriculture (CRIDA) and Member-Secretary of Working Group #2 on "Sustainable Land Use Practices" under the NSC for formulation of NAP (pl. see Chapter 10 for details) and his team at CRIDA have attempted to identify the areas falling within the dryland regions as per Thornthwaite Method of classification and the extent of degradation occurring in these districts. As per their estimation, about 130 mha in the three climatic (arid, semi-arid and dry sub-humid) regions are affected by varying degrees and types of degradation.

4.2 Climate and Desertification

4.2.1 Rainfall Distribution in the Major Climatic Regions

Rainfall distribution over the country varies from place to place. The country, in general, receives about 80% of its annual rainfall during the Southwest monsoon season (i.e. June to September). Rainfall generally exceeds 1000 mm in areas to the east of long. 78° E. It exceeds 2500 mm rainfall almost along the entire West Coast and the Western Ghats and over most of Assam and adjoining Sub-Himalayas and West Bengal. Rainfall decreases from east to west and also from south to north. The peninsula has an elongated area of low rainfall (less than 600 mm).

4.2.2 Rainfall Distribution in the Drylands of India

Arid Zone: These are areas where the water deficit prevails in all months of the year. Rajasthan, Saurashtra and Kutchh come under the hot arid zone. A small area in the Deccan peninsula (Lat. 15°) is also arid.

Semi-arid zone: The areas where water is surplus during some months and deficient in some come under the semi-arid zone. Parts of Haryana Punjab, West Uttar Pradesh, West Madhya Pradesh and also most entire peninsular parts of the Western Ghats are semi-arid.

Dry Sub-Humid Zone: Parts of Northern Plains, Central Highlands, eastern plateau, parts of eastern ghats and plains and parts of western Himalayas fall within the sub-humid region.

4.2.3 Climate and Weather Forecasting: Consistent long-term monitoring of the weather and climate form an essential element to understanding the problem and status of desertification in the country. The India Meteorological Department was established in 1875 and provides the National Meteorological Service in the country. There are about 556 meteorological surface observatories which are engaged in collecting information on weather and climate such as rainfall, temperature, pressure, wind, etc, round the clock. In addition, there are more than 9000 (reporting and non-reporting) rain gauges, 211 Agromet observatories, 216 evaporation stations, 43 soil moisture stations, 41 evapo-transpiration stations, 83 dew fall stations, 21 snow gauge stations, 46 radiation measurement stations, 10 back ground pollution stations and 7 ozone observation stations established in various locations in the country for carrying out specific monitoring. In addition, the Department also has 65 upper air observing stations, which record the upper air wind speed and direction, temperature, humidity, 20 satellite picture receiving stations and 10 cyclone detection radars. In north-west India, 7 pilot balloons-cum-micro-meteorological stations provide low-level wind data for anti-locust operations.

4.3 Drought and Drought Monitoring

4.3.1 Drought: Drought is understood as a period of extreme dryness due to lack of sufficient water. India has been divided into 35 meteorological sub-divisions. A meteorological sub-division is considered to be affected by drought if it receives total south-west monsoon rainfall, less than 75% of the normal seasonal rainfall. Further, it is classified as moderate and severe if the seasonal rainfall deficiency is between 26 to 50% and more than 50% of the normal respectively. A year is considered to be a drought year in case the area affected by one of the above two criteria for drought either individually or collectively is more than 20% of the total area of the country. Based on the data collected using the above criteria during the last 125 years, it has been noticed that there were 25 drought years since 1875 (Annex 4). 1916 was one of the worst drought years when more than 70% of the country was facing drought. During 1965-66 also, a widespread

failure of the summer monsoon rainfall led to prolonged and severe drought condition over considerable part of the country. As a result of severe crop failure, the Planning Commission recommended the study of droughts in India and to develop methods for forecasting crop-yield. This resulted in the establishment of a Drought Research Unit at the Pune Unit of IMD, in June 1967 for (i) undertaking agroclimatic study of droughts, and (ii) formulation of monthly forecasts of overall food production based on meteorological data.

In India, drought occurs more frequently in the arid and semi-arid regions, where the cost of variation of annual rainfall is high. In the arid areas with mean annual rainfall generally less than 400 mm, drought is a very frequent phenomenon. In semi-arid regions, where the mean annual rainfall varies from 400 to 1000 mm, droughts occur in 40 to 60% of the years either due to deficit in seasonal rainfall during the main cropping season or due to inadequate soil-moisture availability during the period of prolonged dry spells between successful rainfall. The regions of the country can also be categorised as drought prone based on the frequency of drought by the region. For example, western parts of West Rajasthan and Kuchch are chronically drought affected. Other areas under dry farming tract come under drought areas (40% of the years examined). The humid and per-humid regions such as Assam rarely face drought. In contrast the hot arid regions can have a frequency of drought once every 2.5 years (Table:4.8)

Table 4.8: Probability of Occurrence of Drought

Meteorological Sub-Division	Frequency of Deficient Rainfall (75% of normal or less)
Assam	Rare, once in 15 years
West Bengal, Madhya Pradesh, Konkan, Bihar, & Orissa South Interior Karnataka, eastern Uttar Pradesh, & Vidharba	Once in 5 years
Gujarat, East Rajasthan, Western Uttar Pradesh,	Once in 3 years
West Rajasthan	Once in 2.5 years

Source: Ramakrishna, Y.S, G.G.S.N.Rao, B.V.Ramana Rao and P.Vijaykumar, 1999

4.3.2 Drought Early Warning

Early Warning Systems related to drought and crop/vegetation assessment in the country have been in operation at Central as well as at the State level through State Departments and Agencies. Drought early warnings are systematically issued by the IMD and the Department of Agriculture, Ministry of Agriculture, Government of India. Many of the State Governments have their own early warning systems. For example, Gujarat has a system called "Weather Watch Group", which draws experts and information from different departments/agencies and provides early warning.

Rainfall is the best indicator of drought over an area. IMD is having a large amount of rainfall data since 1875. Based on these data, drought intensities and drought prone areas have been identified on all meteorological sub-divisions across the country (Annex-5). It is difficult to predict drought well in advance to help the affected regions for implementation of appropriate drought mitigation measures. As the occurrence of drought depends principally on the amount of rainfall, the aim should be to forecast the deficient monsoon season rainfall and its distribution. The India meteorological Department (IMD) is the principal organisation, which measures the rainfall pattern and predicts the imminence of drought on a long range forecasting. To monitor

and assess agricultural drought, a Drought Research Unit (DRU) working under the IMD has developed aridity indices based on rainfall, potential and actual evapo-transpiration, taking into account soil moisture and using water budgeting method.

4.3.3 Agriculture and Meteorology

A Division of Agricultural Meteorology has been functioning in the IMD since 1932 with the main objective to apply meteorological knowledge to agricultural activities. By analysing the rainfall records of about 2000 stations for 70 years, the periods and amounts of 'assured rainfall' have been computed for various regions over India. This information is helpful in selecting appropriate crops for various regions, determining the favourable growing seasons for rainfed crops and selecting drought - tolerant crop. Indian Agriculture is strongly dependent on the monsoon activity, with about 80% of the country being rainfed. Dry Farming Tract is an area where the annual rainfall is between 400 to 1000 mm and with practically no irrigation facility the importance of weather to agriculture is therefore of utmost importance in deciding its success/ failure. The use of weather to agriculture led to the development of agrometeorological concepts relating weather conditions and events to plant growth, crop micro-climate, and production selection of crop species, etc. The DRU of IMD prepares Aridity Anomaly Maps for forecasting drought, which provide a useful indicator of dry conditions/ onset of drought during the rainy season.

IMD provides the following services on weather to farmers:

(a) Agro-meteorological Advisory Service (AAS) of IMD (Farmers Weather Bulletin): Farmers can make immediate and tactical decisions in his day to day field work if they get forecasts in a week to 10 days in advance. Issue of operational Farmers' Bulletins commenced in 1945 from its various regional and State meteorological centres. Weather Service to farmers is one of the important operational services rendered by IMD which started in 1945. Keeping this in view and to render a more effective and purposeful service to the farmers, the Agro-meteorological Advisory Service (AAS) was commenced by IMD in 1975, in co-ordination with State Agricultural Departments. Under the AAS forecast bulletins are issued once a week from 11 Meteorological Centres (MCs) and twice a week from Regional Centres (RCs) in the country.

The National Commission for Agriculture recommended in 1976 that weather bulletins for farmers should include advise on agricultural operations and should be prepared after joint discussions between weather forecasting officer and agricultural officer from local office of agricultural department to make them purposeful. At present agricultural advisories based on prevailing and expected weather conditions are being provided through 17 AAS units of IMD functioning at Ahmedabad, Bangalore, Bhopal, Bhubaneshwar, Kolkata, Chandigarh, Chennai, New Delhi, Gangtok, Guwahati, Hyderabad, Jaipur, Lucknow, Patna, Pune, Srinagar, and Trivandrum. In addition to these services, IMD also provide crop weather outlooks, and crop yield forecast for use of the planners. These bulletins indicate the onset of rains, probable rainfall intensity and duration, weak or break monsoon conditions, occurrence of frost, hail, squall etc. These also contain daily district wise forecasts of weather including heavy rainfall warnings and low temperature, which are injurious to plants. The advisory bulletins are framed taking into consideration the state and stage of crops, agricultural operations in progress, prevalence of pests and diseases, soil moisture studies in conjunction with the prevailing weather and weather expected in the next 24 hours. These advisories are prepared by taking into account the state and stage of the crop, agricultural operations in progress, prevalence of pests and diseases and the immediate impact of weather on the crop. Routine weekly/bi-weekly discussions are arranged

between the Agricultural Meteorologists of the Department and Agricultural officers of the concerned State Departments for preparing these bulletins. The bulletins contain specific advice for the farmers to protect their field crop from adverse weather or to make best use of prevailing favourable weather to increase production. These bulletins are issued twice daily for broadcast in different regional languages through All India Radio Stations (AIRs). These and the daily weather reports prepared by these centres are also published in the newspapers. The bulletins are broadcast over All India Radio in 13 stations on a biweekly basis and weekly by 3 stations throughout the year. These are issued biweekly by Kolkata during the Southwest monsoon season only. In some places they are also telecast by Doordarshan in the regional language of the area concerned in their programmes for farmers.

Box. 4.2. Establishment of a Drought Monitoring Cell by the Government of Karnataka

The Drought Monitoring Cell (DMC) set up by the Government of Karnataka is a unique organisation of its kind in the country. It is involved in issues concerned with the drought situation in the State of Karnataka. It is an autonomous body established in 1988.

The DMC has the following objectives and activities:

1. To identify scientific and technological inputs required to tackle drought in Karnataka.
2. To undertake studies for alleviation of drought and for drought mitigation.
3. Suggest programmes of action.
4. Establish database on drought related factors – precipitation, evapotranspiration, ground water levels and resources, surface water bodies, land use soils, forest cover, etc.
5. To disseminate timely and reliable information on intensity of drought causing factors through media and other means.
6. To understand various manifestations of drought.
7. To develop a network with various resources and user agencies, in order to ensure a functional flow of information and other technological inputs needed to mitigate drought conditions.
8. To initiate, support, and co-ordinate applied research programmes in universities and other institutions in areas identified to be specifically suitable for drought mitigation.
9. To develop science and technology plans relevant to tackle the drought problem.
10. To undertake activities at 1-9 for problems with other hydro-meteorological events.

All India Coordinated Research Project on Agrometeorology (AICRPAM): The frequent occurrence of famine conditions and loss of agricultural productivity from adverse weather events led the planners to look for measures to strengthen agrometeorological research. The establishment of “All India Coordinated Research Project on Agrometeorology” (AICRPAM) in 1983 with 12 cooperating centres was an outcome of these efforts, which expanded to 25 in 1995 to cover all agricultural universities in the country located in different agro-climatic zones. The AICRPAM and its centres are functioning as nodal centres for this network, which has now covered 73 of 127 agro-climatic sub-regions of the country.

Flood Control: The IMD, with the purpose of checking soil erosion, has also set up seven Flood Meteorological Offices have been established at Lucknow, Patna, Guwahati, Bhubaneswar, New Delhi, Jalpiguri, and Ahmedabad. The floods often cause erosion of fertile soil and leads to land degradation.

National Centre for Medium Range Weather Forecasting (NCMRWF): Since the advisory bulletins are based on short range (upto 72 hours) in advance weather forecasts, their effective validity is practically over by the time they reach the users. Moreover, these are on very broad spatial scale to cater to the specific needs of

farmers. Keeping these and developments in the field of numerical weather prediction, computing technology, telecommunication and varied requirements of the farmers, in view, the Government of India approved a project of National Centre for Medium Range Weather Forecasting (NCMRWF) in 1989 with the prime objectives of: (a) developing operational capability of medium-range (3 to 10 days in advance) weather forecasting capability and (b) agrometeorological advisory service for each of 127 agroclimatic zones of the country. The Project is being implemented by the Department of Science & Technology mainly in collaboration with IMD, ICAR and the State Agricultural Universities. The agrometeorological advisory component is being implemented through agricultural research and extension stations established in different agroclimatic zones and are functioning under ICAR and the State Agricultural Universities (SAUs). In order to evolve viable structure, establishment of experimental AAS units which was commenced in 1993 has now been extended to 82 agroclimatic zones of the country. NCMRWF disseminates weather forecasts (currently 4 days) to these units for their respective zones (through VSAT, fax or phone) and agricultural scientists of the concerned stations prepare advisories for the farmers which are then disseminated to the users through mass media (local newspapers radio, and TV), personal contact, extension personnel, etc. These bulletins are issued twice a week at most of these stations. AA units also provide local agrometeorological data and farmers feedback on the advisories. (NCMRWF, 2001).

4.3.4 Use of Remote Sensing Applications: The Department of Space, Government of India uses remote sensing data for early warning under NADAMS. IRS-WiFS data and NOAA-AVHRR data is being used for issuing early warning in the country. Two band data is used to generate Normalised Difference Vegetation Index (NDVI). These NDVI images are composited over every fortnight to provide early warning on the crop condition and general agricultural drought. The early warning are given by issuing bulletins. At present, eleven States of the country- Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, and Uttar Pradesh are covered under the programme of early warning and bulletins giving the district-wise status are issued from August to October. These bulletins are sent to the concerned State Government (Agricultural Department and Relief Commissioner).

4.4 USE OF BENCHMARKS AND INDICATORS

Apart from the use of climatological data, monitoring and assessment of desertification has been also done using a number of benchmarks and indicators. These are covered in detail in Chapter 8, sub-section 8.3.1.

Chapter 5

Factors, Processes & Impacts of Desertification

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Chapter 5 Factors, Processes and Impacts of Desertification in India

Highlights of Chapter 5

The major causes of land degradation in the country are deforestation, unsustainable agricultural and water management practices, land use changes for development, and industrialisation. The major process of land degradation is soil erosion (due to water and wind erosion), contributing to over 71% of the land degradation in the country. Soil erosion due to water alone contributes to about 61.7% and that by wind erosion 10.24%. The other processes include problems of water logging, salinity-alkalinity. The process of desertification is impacting every aspect - loss of agricultural productivity, loss of natural resources (forests and vegetative cover, biodiversity, soil changes), socio-economic conditions (economic losses, problems of sustenance, decline in quality of life), etc.

Desertification is land degradation in the drylands due to a number of factors including climatic variations and human activities. Man-made causes include, expansion of agriculture and unsustainable agricultural practices such as over cultivation, nutrient inputs, poor irrigation practices, deforestation and overgrazing. Such unsustainable resource management practices are often induced by population pressures, social conflicts and disruption of social systems, inappropriate government policies and poverty. People affected by desertification often need to draw on their limited assets in order to survive, which accentuates their poverty. This constitutes a vicious cycle linking deteriorating natural resources to deteriorating livelihoods as people need to encroach further on fragile soils, sparse vegetation and limited water resources to meet their basic needs for food, shelter and livelihood. Many of the complex causal relationships are not fully understood. It is often very difficult to separate the causes from the effects.

5.1 Major Factors causing Desertification in India

The major causes of desertification in the country are:

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| (i) | Unsustainable Agricultural practices | - | Extensive and frequent cropping of agricultural areas. |
| | | - | Excessive use of fertilisers. |
| | | - | Shifting cultivation without allowing adequate period of recovery. |
| (2) | Unsustainable Water Management | - | Poor & Inefficient Irrigation Practices. |
| | | - | Over abstraction of ground water, particularly in the coastal regions resulting in saline intrusion into aquifers. |
| (3) | Conversion of land for other uses | - | Prime forest into agricultural land. |
| | | - | Agricultural land for other uses. |
| | | - | Encroachment of cities and towns into agricultural land. |

- (4) Deforestation.
 - Unsustainable forest management practices.
 - Forest land clearances for agriculture (including shifting cultivation)
 - Other land use changes (Projects- energy, roadways, etc).
 - Overgrazing, excessive fuel wood collection.
 - Uncontrolled logging and illegal felling and
 - Forest fires.
 - (5) Industrial, mining and other activities without satisfactory measures for prevention of land degradation and land rehabilitation.
 - (6) Demographic pressures - human and livestock.
 - (7) Frequent droughts/failure of monsoon and their link with global climate phenomena.
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5.1.1 Unsustainable Agricultural Practices:

Unsustainable agricultural practices include excessive use of fertilisers, pesticides, frequent cropping patterns, inappropriate technologies, or choice of crops/ plants, etc. Non-point sources of pollution is a problem in areas with wide application of fertilisers.

5.1.2 Unsustainable Water Management Practices: Poor & inefficient irrigation practices, over abstraction of ground water, particularly in the coastal regions resulting in saline intrusion into aquifers, etc. are some of major unsustainable water management practices which has led to problems of desertification in such regions. Overabstraction of groundwater without compensatory recharge has led to depletion of groundwater table.

5.1.3 Land Use changes. : Diversion of land from forestry and agriculture to other land uses has been one of the principal causes of land degradation Diversion of forest lands for non-forestry purposes was curtailed with the enactment of Forest (Conservation) Act, 1980 with the objective of arresting diversion of forest land for non-forestry purposes. Wherever diversion of forest land is unavoidable, for instance for developmental projects (energy, infrastructure, transportation, etc.) compensatory afforestation on non-forest land is mandatory. However, loss of prime forests could have an impact in the long-term stability of the forests. The other land use change is due to encroachments, through violation of forest boundaries, illegal farming in forests. Due to their illegal status, they are unable to receive extension services and improve their farming systems, further accelerating land degradation. The encroachment of forest land, and the socio-economic pressure to regularise them, continue to be the most pernicious problem of forest protection.

5.1.4 Deforestation: It is difficult to separate the causes from the effects of deforestation and forest degradation. Some direct causes of deforestation are land clearances for agriculture (including shifting cultivation), other land use changes including unplanned urbanisation, land transfers, different forms of encroachments, over-grazing, uncontrolled and wasteful logging, illegal felling, and excessive fuelwood collection.

Shifting Cultivation: Shifting cultivation refers to a farming system in which a short but variable cultivation phase (on slash-and-burn land) alternates with a long and equally variable fallow period. With increasing pressure on forest lands, and shortening on the fallow period, this practice of farming which was once in balance with nature has become disorderly causing considerable damage to the regeneration of forests cleared in this manner. Deleterious effects include deforestation, spread of sterile grassland, soil erosion, and loss of productivity of forest and agricultural land.

Collection of Fuelwood: Consumption of wood (timber and fuelwood) in India is considerably (4 to 5 times higher than what can sustainably be removed from the forests. Much of the rural energy for cooking comes from collection of fuelwood from forests. In 1990, the estimated removal of fuelwood was about 250 million cu.cm, which has been estimated to increase to 310 million cu.cm by 2000 (NFAP, MOEF, 1999). This contributes to the overall deterioration of the quality, stocking condition and productivity of the forest ultimately leading to deforestation and degradation.

Grazing in Forest Land: Forest land are an important source of grazing and fodder in the absence of adequate pasture land and a viable policy of fodder development. It is estimated that that over 270 million livestock consisting of over 50% of India's livestock graze in the forests (NFAP, 1999). These include traditional ethnic sedentary village livestock and migratory animals herded by ethnic grazers. Additionally grazers collect an estimated 175 to 200 million tonnes of green fodder annually. This results in overgrazing and over-extraction of green fodder, leading to forest degradation through damages to regeneration and compaction of soil. A sample survey of FSI estimates that impact of grazing affects 78% of the country's forests, of which 18% suffers high incidence and 31% medium incidence. Grazing occurs even in protected areas. In another survey, 67% of the national parks and 83% of the wildlife sanctuaries surveyed reported grazing incidences.

Forest fires: Forest fires, mostly ground fires affect annually about 35 mha of forest area. These are by and large incendiary in nature. The environmental impact of these depend on forest type. The nature and severity of damage depend on the type of forest, availability of fuel and climatic factors.

5.1.5 Industrial and Mining Activities

5.1.5.1 Industrial Activities: Industrial effluents and mining are also gradually emerging as important agents of desertification. In most cases the root of the problem is the mismanagement by land users and poor implementation of pollution control regulations. Industrial effluents and their discharge into inland waters and irrigation with poor quality water in many parts of the country are rendering stretches of land in some of the States as degraded. Industrial effluents from textile, printing and dyeing industry and their discharge into streams and rivers, which are non-perennial with no flow during the lean season severely contaminates them. Use of such waters for irrigation has affected agricultural land as well. Besides productivity decline or complete loss, progressive degeneration of bio-diversity is yet another major consequence of land degradation. In many areas the groundwater has been polluted. Some of the most affected areas are found in Pali, Jodhpur and Balotra in Rajasthan due to dyeing industry, Bicchri also in Rajasthan due to discharge of highly toxic effluents, large tracts of land have been rendered unfit in industrial estates such as Vapi, Ankleshwar in Gujarat, Pattancheru, Bollaram in Andhra Pradesh which house large a large number of chemical manufacturing units, Vaniyambadi in Tamil Nadu due to effluents from leather processing industrial units.

5.1.5.2 Mining Activities: Mining is another major industry, which is a factor of desertification in the country. This is especially with unplanned open cast mining and dumping of mine refuse in the vicinity of agricultural lands. Despite guidelines and regulations for undertaking adequate environmental measures mining operations, open cast mining of sandstone, limestone, marble, gypsum, and clay is largely practised by small scale entrepreneurs who do not take up post mining operations. Consequently, such areas are gradually turned into wastelands. China clay, Fuller's earth, calcite and gypsum generate fine particles which are washed down the slopes with runoff and get deposited in the adjoining cultivated fields. This eventually leads to problems of waterlogging and salinity.

5.1.5.3 Disposal of Solid & Toxic Wastes onto Land: In many parts of the country such as Vapi, Ankleshwar, in Gujarat; Pattancheru and Bollaram in Andhra Pradesh, Pali, Balotra in Jodhpur large tract of land have been rendered useless due to disposal of toxic industrial wastes. In some areas, this has led to ground water contamination as well. The costs for reclamation of such land, if carried out as per requirements, would be enormous.

5.1.6 Demographic pressures: Population pressures is a significant factor for land degradation.

Population Pressures in the Arid Region: The general problem of arid areas with large populations is essentially one of human ecology. The inherently limited resources within arid and semi-arid regions set the ultimate limit of production are finally dependent. Furthermore, erratic rainfall results in widely fluctuating production leading to scarcity, which imposes stress on these populations. In general, the population density of both human and livestock in the arid region is much higher than the national average. The decennial growth rate of population during the decade 1981-91 in the desert region was 29% as against 23% for the country (MOEF, 1996). The livestock population also increased from 9.4. million in 1951 to 14.4. million in 1961 (53% increase) and to 15.52 million in 1971 (8% increase). The density of livestock on grazing lands has consequently increased. The increase of cattle, buffaloes and camels has been very high in this region. As population increases, the demand on natural resources is further magnified. This has led to further intensive use of land and other natural resources in drier regions. The consequence is an imbalance between the human and animal population on the one hand and plants, water, and land resources on the other. As the demand by the first persists and increases, the resources tend to become depleted and, as depletion proceeds, the stress upon them becomes even greater. Thus, a process of progressive degradation of resources is set into operation, which intensifies with drought. If not checked timely and effectively, it leads to loss of vegetation, leading to loss of biodiversity. The barrenness of the land affects the hydrological cycle which can affect the rainfall pattern for the region. In the semi-arid, sub-humid regions of the country also, there are some areas such as the Gangetic Plains, where the population density is one of the highest in the world.

5.1.7 Drought and Land Degradation: Drought is generally a naturally occurring phenomenon due to deficit of rainfall in a region. However, drought effects can be exacerbated due to absence of vegetative cover impacting the hydrological regime. Drought could thus be another causative factor for land degradation. Arid and semi-arid regions in the country encounter moderate to severe droughts frequently leading to crop failures and famines. While droughts of transient nature may not cause significant adverse effect on the crop and livestock production, severe droughts of recurring nature lead to lower biomass production, poor grain yields and scarcity of fodder. In areas with restricted growing season and soils of poor water holding capac-

ity, droughts have a significant impact on the total biomass yield. Such situations result in minimal inputs of organic carbon into the soils. Even the biomass recycling through leaf litter from perennials is reduced. Further more, scarcity during drought years leads to enhanced grazing pressure by the livestock which accentuates the problem of loss of vegetative cover. The process is aggravated if the following year also is a drought year. This way recurrent droughts lead to land degradation mainly through decline in biomass production and depletion of organic carbon (humus) in the soils. It is, therefore, not surprising that some of the most severely degraded land are found in the chronically drought prone areas having shallow and light textured soils.

5.2 Processes of Desertification

The different processes involved in land degradation include:

- (i) Wind erosion
- (ii) Water erosion
- (iii) Salinity-Alkalinity
- (iv) Waterlogging

5.2.1 SOIL EROSION

Soil erosion by water and wind account for 87% of the area affected by soil degradation. It has been estimated that between 1977 and 1997 the area critically affected by erosion has almost doubled.

5.2.1.1 Wind Erosion: Wind erosion is the major process of land degradation in the hot arid regions of the country affecting 10.46 mha. These include the States of Rajasthan, Haryana, Gujarat, and Punjab, covering an area of 28,600 sq.km of which 68% is covered by sand dunes and sandy plains. Wind erosion is also prevalent in the coastal area where sandy plains dominate and in the cold desert regions of Leh in Jammu & Kashmir (Prasad & Biswas, 1999).

5.2.1.2 Water Erosion: Water or run-off induced soil erosion is the most serious process of land degradation and desertification in the country affecting about 107.1 mha of the country's geographical area. In the Indian context, it results in loss of topsoil and terrain deformation (ravines, gullies, etc.) (MOA, 1985). The broad types of water erosion are given in Table 5.1. Soil erosion through accelerated sheetwash and rill / gully development occurs mainly in the Saurashtra and Kutchh uplands and along the eastern margin of the Thar in Rajasthan, where the average rainfall varies from 350 mm to 500 mm. The major reasons are increased cultivation of marginal land with high slopes and shallow soils, destruction of natural vegetation for fuel and fodder, overgrazing, and other environmentally destructive uses. In the Aravalli Hill ranges along the eastern margin of the Thar, the hill slopes are being regularly denuded of natural vegetation cover for fuelwood, and fodder. Consequently the soils are being washed out by sheet rill and gully erosion, so much so that in many areas there is hardly any soil left to start a replantation programme. In Kutchh region, the problem is partly related to a slow natural upliftment of the terrain over the centuries, leading to a change of base level and increased erosion.

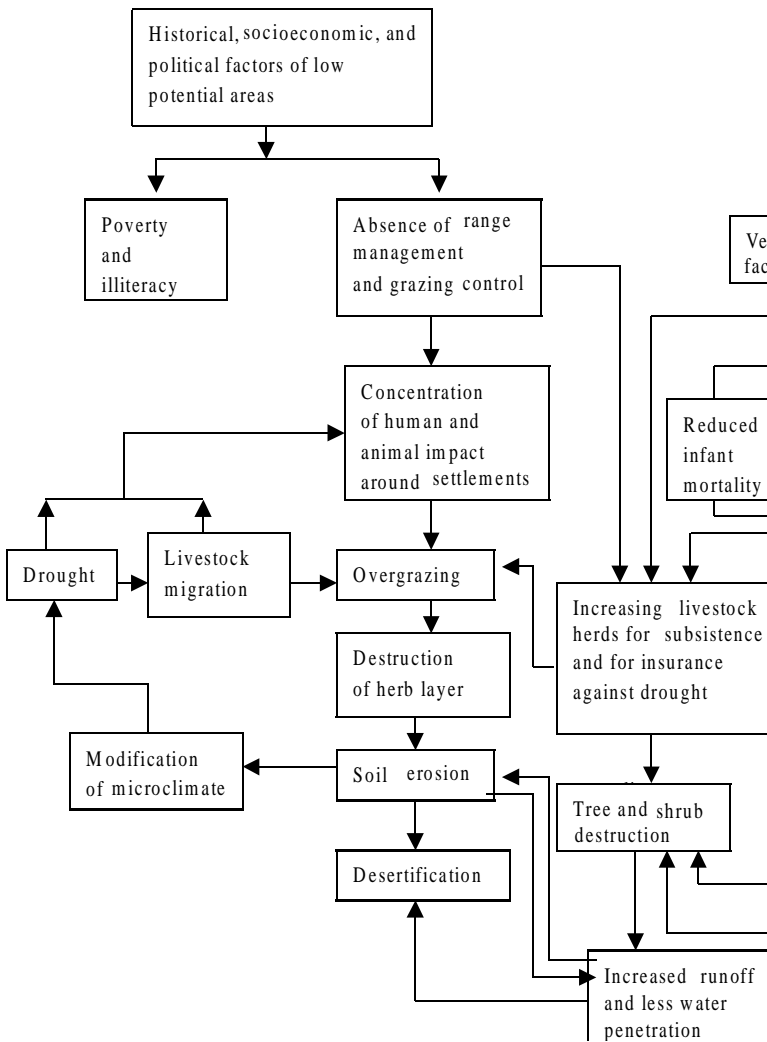


Fig. 5.1. Pathways showing process of desertification in India
(Kaul, R.N., 2000)

Table 5.1: Types of Soil-Induced Erosion

Types of Erosion	Predominant In
Sheet erosion	Indo-gangetic plains, Northern Himalayas, Nilgiris.
Gully and ravine erosion	Major area in the Central India in the Indo-gangetic plain along the Yamuna and Chambal. Also some areas in Western, central, and eastern India, and in the foothills of Himalayas.
Torrent and Stream Channel Erosion	Foothills of the northern and north-eastern Himalayas, Assam valley.
Erosion due to shifting cultivation	North East Hill Region

Runoff induced erosion is quite prevalent in most States of India located in the arid, semi-arid and dry-sub-humid regions. The annual water erosion rate ranges from less than 5t/ha/yr (for dense forests) to more than 80 t/ha/yr in the Shivalik hills (Prasad & Biswas, 1999). Sheet erosion affects red soils comprising Alfisols, ultisols, and oxisols (4-10 t/ha/yr) and black soils constituting Vertisols and Vertic soils (11-43 t/ha/yr). Gully erosion severely affects hilly areas (more than 33 t/ha/yr), while hill slope erosion affects 13 mha (more than 80 t/ha/yr). Runoff erosion has resulted in extended and deep gullies in vast areas of Uttar Pradesh (AESR 9.2), Madhya Pradesh (AESR 5.2), Rajasthan (AESR 2.3 and 4.2), Bihar (AESR 13.1), Gujarat (AESR 5.1), Maharashtra (AESR 6.1 and 6.2), Andhra Pradesh (AESR 7.1 and 7.2), Tamil Nadu (AESR 8.3) and Karnataka (AESR 3.0, 6.4 and 8.2).

Among the soil groups undergoing serious erosion by water are red, black and the mountain soil regions. The vertisols in penninsular India are highly erosive because of a high run-off rate (40-50% of the total rainfall), high erosive slope and poor permeability. The laterite soils suffer from rill erosion losing almost 40t/ha/yr in the absence of adequate soil conservation measures (Prasad & Biswas, 1999).

Ravines: Ravines are a kind of network of gullies formed as a result of water erosion and they are found generally in deep alluvium and entering a nearby river. It is estimated that about 3.97 mha area is affected by **ravines** in States of Uttar Pradesh, Madhya Pradesh, Gujarat, Rajasthan, Punjab, Maharashtra and Orissa according to estimates, in the regions along the banks of rivers Yamuna, Chambal, Mahi, Tapi and Krishna. Ravines have been classified into shallow (3 to 6m), medium (6 to 9m) and deep (>9m). Further they have also been classified based on their suitability for reclamation for operational convenience (ICAR, 1999).

5.2.2 Soil Salinity- Alkalinity

Vast areas in the otherwise productive Indo-Gangetic plain cutting across the states of Haryana, Punjab, Uttar Pradesh and some coastal regions of Gujarat have lost their productivity due to soil salinity–alkalinity. These soils are characterised by excess soluble salts with sodium carbonate in substantial quantity. Consequently, the soils accumulate sodium on the exchange complex thus resulting in poor physical properties including low infiltration rates. In many areas a layer of calcium carbonate concretion (*kankar pan*), which is normally found at a depth of 1 m, acts as a barrier for root penetration into the soil. The soil pH is high adversely affecting germination, plant growth, and nutrient availability to plants. The process of salinisation sets in due to (a) irrigation with ground water containing excess of carbonate and bicarbonate ions (second-

ary salinisation), (b) runoff from adjoining undrained basins, and (c) rise in ground water table as a consequence of mismanagement of irrigation command. This is a man-made problem. In addition, there is natural salinity in depressions in landscaping of lower elevations.

5.2.3 Water Logging

Waterlogging is estimated to affect about 8.52 mha of the land surface. The problem is severe in the Indira Gandhi Canal Command Area in Rajasthan, where excess irrigation in the soils having gypsum-rich barriers at shallow depth and wrong drainage planning are the major causes for degradation in these canal command areas, leading to saline-sodic water and a salt-rich hard pans. Some areas of Uttar Pradesh, Haryana and Punjab under agriculture also have this problem. According to a World Bank study, India loses 1.2-2.0 million tonnes of foodgrain production every year due to water logging (ICAR, 1999).

5.3 Impacts of Desertification

5.3.1 Impact of Human Population Pressures on Forest Resources: Population pressures per unit area of forest is one of the highest in the world. In 1991, the national average density of population per sq. km of forestland was 1320 and ranged from 2860 in the north western States to 191 in the north eastern region. Consumption of wood (timber and fuelwood) in India is considerably (4 to 5 times) higher than what can sustainably be removed from the forests. In 1990, the excess removal of fuel wood was estimated to be about 250 million cu.m with an expected increase to 310 million cu.m by 2000 (NFAP, MOEF, 1999). These are steadily adding to forest degradation and deforestation.

5.3.2 Impact on Biodiversity: Owing to degradation of forests and natural habitats for expansion of agriculture, river valley projects and industrial and urban developments, the biodiversity of the country are under threat, some of them for survival itself.

Box 5.1: Adverse Impacts of Deforestation

Environmental Impacts

- Loss of ecological stability.
- Loss of biodiversity.
- Reduction in carbon sink capability and their effects on climate.
- Floods, drought and related losses.
- Damages to watershed
- Soil erosion.
- Silting up of reservoirs.
- Desertification and Drought.
- Changes in hydrological regime.

Social and Economic Impacts

- Loss of employment.
- Food and Livelihood security.

Source: NFAP, 1999

5.3.3 Impact of Livestock Population Pressures on Grazing & Forest Land Resources: India's high livestock population is increasing further. Most livestock farming is of low productivity. With the steady rise in animal, especially cattle population in the country, pastures and grazing lands have been subjected to overuse. This has resulted in loss of vegetation and affected their regeneration potential leading to slow degradation of grazing land, which eventually become barren. A substantial percentage of pasture and grazing lands has been encroached upon for agricultural & other purposes. The reduction in the extent of availability of land for grazing has led to more and more forests being used as grazing grounds.

Table 5.2: Livestock grazing on forestland (in millions)

Year	Livestock grazing
1957-58	35
1973-74	60
1995 (estimate)	90

Source: NFAP, 1999

Livestock production in India is to a large extent dependent on crop residues and crop by-products. The total supply of feed and fodder in 1993 was straw 398 million tons, green fodder 573.50 million tons, and concentrates 41.98 million tons (MOEF 1993 estimates). It is estimated that during 1993, the country faced a deficit of 570 million tonnes green fodder, 276 million dry fodder. The 1995 combined availability of green fodder from permanent pastures, other grazing lands, agricultural lands and forests was estimated at 434 million tonnes, whereas the minimum requirement was estimated to be 882 million tonnes. The big gap has resulted in unlimited and unrestricted grazing in forest lands. (SOE, 1995). Forests have been an important source of grazing and for fodder in the absence of adequate pastureland. It is estimated that about 270 million livestock graze in forests. Additionally, grazers collect an estimated 175 to 200 million tonnes of green fodder annually. This further results in overgrazing and over extraction of green fodder leading to forest degradation through their deleterious effects on soil compaction and poor regeneration of forests (NFAP, 1999).

Livestock are increasing at a rate of 2% per annum mounting a tremendous pressure on the limited land resources (ICAR. 1999). There has been a steady decline in the area and quality and quantity of CPRs, as a result of increase in population and livestock pressures. About a third of the total feed intake of the ruminants in India, large and small, is by grazing on common property resources (CPRs). Overgrazing by herds far larger than what the land can sustain, year after year, has progressively rendered them into marginal or wastelands, grossly eroded and changing plant association, making them unsuitable for bovines and fit only for sheep and goats. It is clearly understood that the cause and effect of all these retrogressive changes in the common property resources (CPRs) and more generally on the ecosystem, emanates from the enormous increase in human population followed by increase in animal populations, far beyond the land's ability to sustain and provide for.

5.3.4 Impacts of Depletion of Vegetative Cover: One of the impacts is the gradual change of ecosystem through loss/replacement of one species with another. In many parts of Rajasthan, there has been a

gradual change in the natural vegetation found in the region and plant density. For example, in the sandy areas of less than 200 mm annual rainfall zone, the grass species such as *Lasirus indicus-Elesine compressa* are being slowly replaced by *Aristida funiculata - Dactyloctenium indicum*, with a concomitant decline in basal cover and plant density. Similarly the permanent pastures and fallows in the high rainfall zones which once supported a good stand of trees and shrubs now present a stunted landscape. At many places the original species are being replaced by poor quality shrubs and grasses like *Crotalaria burhia*, and *A. funiculata*. The common grazing lands around villages have now turned as some of the severely degraded sites, due to over exploitation and gross neglect. Encroachment of these village commons for crop production and other non-farm activities has also led to conversion of these pasturelands to other uses. On an average, the area with good grass species in the < 300 mm average annual rainfall has declined by about 7% while in the >300 mm average annual rainfall zone the decline has been far greater from 8 % to 12%. This has a significant effect on the potential fodder production from these lands (Singh, et.al. 2000).

5.3.5. Impacts of Soil Erosion

5.3.5.1. Impacts of Wind Erosion: Sand dunes and other sandy land forms in the Thar desert are most vulnerable to wind erosion/deposition. Sandy land forms in the western part of the desert (Agro-ecological Sub-Region (ASER): 2.1, 2.3) are more unstable and vulnerable than those in the east. This is especially due to the decreasing rainfall and increasing gradient in the wind velocity from east to west direction. The threshold velocity for initiating wind erosion has been estimated to be around 10 km/hr (Prasad & Biswas, 1999). However, wind velocities of as much as 30 km/hr are common, leading to loss of topsoil and terrain deformation in the affected regions. In other parts of the Thar and in western parts of Haryana, large-scale introduction of tractor ploughing in the sandy terrain, including the dune slopes, is increasing the sand load manifold for aeolian processes, and is threatening more areas through new sand dune formation and advancement of old dunes. Destruction of natural plant cover in the sandy terrain for fuel and fodder, extending the areas of cultivation to less suitable sandy tracts and higher slopes of sand dunes, land levelling in the Indira Gandhi Canal Command area also accelerating the aeolian process.

5.3.5.2. Impacts of Water Erosion: The national average of rate of soil erosion, based on existing soil loss data, has been estimated as 16.35 t/ha/yr, yielding a total soil loss of 5.3 billion tonnes annually in the country (Prasad & Biswas, 1999). About 64% of the eroded soil comes from the Shivaliks, the western Ghats and the north-eastern States. Of the eroded soil, nearly 29% of the total eroded soil are permanently lost to the sea, 10% end up in reservoirs and about 61% transferred from one place to another. The transfer of eroded soil into reservoirs results in the reduction of the storage capacity by 1-2 % annually. The data on river valley projects on 17 medium and small reservoirs in India have shown that the rate of inflow of sediment is about 3 times (9.17 ha-m/100 km²/annum) compared with the design rate of (2.93 ha-m/100 km²/annum), rendering their life expectancy and the hydroelectric power generation to one-third the planned capacity. (Samra & Pratap Narain, 1999). The annual water erosion rate has been estimated to range from less than 5 t/ha/yr (for dense forests, snow clad mountains and arid desert regions) to more than 80 t/ha/yr in the Shivalik Hills. The annual erosion rate in the north-eastern region (which practice shifting cultivation) showed top soil losses exceeding 40 t/ha/yr. The annual erosion rate in the Western Ghats and the coastal regions varied from 20 to 30 t/ha/yr and can be as high as 60 to 70% if they are under shifting cultivation. This results in formation of ravines which affect a land area of approximately 3.97 mha and occur along the banks of the rivers Yamuna, Chambal, Mahi, Tapti, and Krishna, and regions with shifting cultivation regions affecting about 4.91 mha in the north-eastern regions.

5.3.5.3. Impacts of Erosion on Soil Fertility: Soil erosion is directly linked to deterioration of soil health which in turn affects crop productivity and sustainability (Prasad & Biswas, 1999). Erosion also takes away with it every year 14 million tonnes of such major nutrients as nitrogen, phosphorus, and potassium from the country's soils. Red and lateritic soils are particularly prone to this problem. Intensive cropping has further hastened the process of nutrient removal. The eastern part of Jammu and Kashmir (AESR 1.1) is the worst affected with respect to loss of soil organic matter (SOM) besides parts of Rajasthan and Gujarat. SOM is one of the key resources supporting crop productivity. However, it is a dynamic resource responding to the changing land uses and input-output ratios. It has a significant bearing on soil properties related to productivity as also erosivity. Under intensive cropping and imbalanced fertiliser application systems (relying largely on N fertilisers), SOM content declined irrespective of the cropping systems and soil types.

The Government of India has not estimated the economic losses due to impacts of all the factors and processes of land degradation. According to the Tata Energy Research Institute (TERI), New Delhi, the economic losses caused by lower crop yields, and reduced reservoir capacity has been estimated to be in the range of 89-232 billion rupees, as a result of loss of 11-26% of agricultural output (TERI- GREEN India- 2047).

5.3.6. Impacts of Inefficient Water Management: Inefficient water management is observed at all levels - city, province, and village leading to drought-like situations. In places of acute water scarcity, long hours are spent for collection of water which affects the quality of life and is a direct loss to the economy. The availability of renewable freshwater resources per capita in India has fallen from 6000 cubic metres in 1947 to about 2300 cubic metres in 1997 (TERI report). The adverse impacts of temporary/long-term fall of waterlogging are reflected in overall effect on the ecology, reduced agricultural output, limited choice of crops, and impacts on the socioeconomic conditions of the affected region. According to a World Bank study, India loses 1.2-6.0 million tonnes of foodgrain production every year due to water logging (Prasad & Biswas, 1999).

5.3.7. Impacts of Overabstraction of Ground Water : The excessive pumping of groundwater for irrigation purposes in intensively cultivated areas of Punjab, Haryana, and Western Uttar Pradesh has caused the lowering of ground water table in certain pockets. The States that currently overexploit groundwater the most are also the country's agriculturally important States, each with a net irrigated area of over 0.3 million hectares, groundwater is the predominant source of irrigation in eight States (TERI-GREEN, India 2047). During the past decade, ground water table has dropped at a rate of 0.5-0.8 metre per year in Haryana and 0.2-1.0 m per year in Punjab. Major metros such as New Delhi, Chennai have over exploited their ground water and the levels have dropped drastically. The overexploitation of groundwater in some areas has made its extraction increasingly expensive and not viable. The effect of such high costs is likely to be particularly severe on small and marginal farmers. A falling water-table requires greater expenditure on extraction, which the small and marginal farmers can ill afford. In Kutchh region of Gujarat, over extraction of ground water has led to saline water intrusion into coastal aquifers resulting in deterioration of water quality. Reclamation of saline ground water is one of the most difficult problems of reclamation of degraded lands.

5.3.8 Impact of Desertification on Decline in Quality of Life:

Quality of life of rural communities is by food security, water security, sustained availability of fuel and fodder and adequate income generation. Responsibility of collection of fuelwood, fodder and water requirements of

the family in many rural areas rests with the womenfolk. The quality of life of women particularly in the severely affected regions of the country, especially belonging to the backward communities, is extremely hard. Many of them spend a life of drudgery spending large amount of their daily time for collection of fuelwood, food, fodder and water needs of the family. Increase in collection time indicates a progressive degradation of the land and a corresponding decline in quality of life of people in such regions. In many areas, the men have migrated to cities and the women are the *de-facto* heads of families looking not only after children but also responsible for all aspects of running the household and their livelihood. The contribution and importance of women in the development of the family unit as well as to the local community and to the economy has not been given the attention that it deserves.

5.3.9 Impacts of Desertification on Migration from Rural Areas and Urbanisation:

Where urbanisation in the industrialised countries resulted from industrial development, today, urbanisation in developing countries is the result, in most cases, of pressures from declining quality of life in rural areas. As per the 1991 census, 26% of the country's population (217 million) live in urban areas. This is expected to be about 300 million in 2001 and is expected to rise to 590 million by 2025 (Report of GOI to CSD, 1994). Twenty three metropolitan cities account for 32.5% of the urban population in the country. Desertification, *per se*, is not the only reason for migration to cities and nor is migration the only source of urban growth. In fact with the advent and expansion of the electronic media, the hopes and aspirations of people have increased enormously, which is also one of the contributing factors to migration to cities. The changing role of media also has profound implications on the changing consumption patterns which have direct and indirect impacts on the natural resources. There is a well-established correlation between desertification and migration from rural areas. Forced migration to urban areas due to desertification leads to an inability to adjust to exigencies of urban living and hence creation of slums and the associated social stress (UNCCD, 1997). In India, migration throws most urban Plan Programmes out-of gear and leads to an inability to provide basic civic services and facilities such as housing, water supply, energy, transportation, etc. leading to creation of unauthorised colonies and slum clusters in towns and cities, increased pollution and environmental degradation and the consequent decline in the quality of life.

5.3.10 Impact of Desertification on Climate

The extent of impact of desertification on climate is a very complex phenomenon not fully understood. The changes in vegetative cover due to various human-induced changes can influence the solar radiation and thus the energy balance of both the surface and atmosphere of the earth (WMO, 1996). For example, any change in the surface albedo (reflection of sunlight) (due to vegetative loss) will affect the amount of solar radiation absorbed by the surface. Similarly, changes in soil moisture levels will determine the portion of energy that is used in evaporation and transpiration processes, which in turn affects the micro-climate. Other factors such as wind speeds, surface temperatures influence the evapo-transpiration rates.

Chapter 6

Measures to Combat Desertification and Mitigate the Effects of Drought

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Chapter 6

Measures to Combat Desertification and Mitigate the Effects of Drought

Highlights of Chapter 6

This chapter explains in considerable detail the various policies, strategies, legislative and institutional framework and the various plans, programmes and measures that are under implementation for the conservation and eco-restoration of natural resources and degraded lands, community-based and social sector programmes for human development and local area development for improving the socio-economic conditions of the local people.

The chapter also explains in detail the technologies available for conservation of land resources and for eco-restoration of degraded lands. Specific programmes, measures and technologies for drought mitigation are also given. The chapter also highlights the traditional technologies available in the country for desertification and drought mitigation.

The Chapter is divided into four main sub-sections:

- A. Policy, Strategy and Legislative Framework.
- B. Planning, Programmes and Institutional Framework.
- C. Monitoring mechanism.
- D. Technologies for Combating Desertification and Drought.

A. POLICY, STRATEGY AND LEGISLATIVE FRAMEWORK

6.1 Constitutional Provisions and Obligations

Environmental conservation has been an integral part of the Indian ethos. These are reflected in India's Constitution adopted in 1950. Articles 48A and 51G of the Directive Principles of State Policy enjoin upon the State to protect and improve the environment and safeguard the forests and wildlife. The Constitution of India also enable the Centre and the States to enact laws to carry out the duties of preservation, afforestation and conservation of natural resources. Article 39(b) and (c) lays down the duty of the State and the Centre to develop natural resources for common good. Article 40, on the other hand, calls for organisation of village as units of self-government. The Directive Principles of State Policy, though not enforceable by any Court, are nevertheless fundamental to the governance of the country. Thus, a favourable atmosphere for empowering grassroots communities and for assisting them to take initiatives in the areas of environmental management, including combating desertification, already exists.

The Constitutional provisions in respect of allocation of responsibilities between the Centre and the States fall into three categories: the Union List (List-I), the State List (List-II), and the Concurrent list (List-III). Land and Water are subjects within the purview of the States. However, 'Forest' was a State subject earlier, and was brought to the Concurrent list in 1976. The subject 'Environment' is not under any List but is covered under the Directive Principles of State Policy and Fundamental Duties enshrined in the Constitution 'to protect and improve the environment'.

Fundamental Rights in the Constitution also ensure equality before the Law, equal protection of religion, race, caste, sex, or place of birth and guarantees equal opportunity to all citizens in matters relating to employment. Further, the Constitution of India not only grants equality to women but also empowers the State to adopt measures of positive discrimination in favour of women for neutralising the cumulative socio-economic, education and political disadvantages faced by them. Articles 14, 15, 15(3), 16, 39(a), 39(c), and 42 of the Constitution of India are of specific importance in these regard.

6.2 Policy

6.2.1 National Water Policy, 1987

The Government of India (Ministry of Water Resources) prepared a National Water Policy in September 1987. The Policy is a broad statement covering the following aspects:

- In the planning and operation systems, water allocation priorities has been given to:
 - Drinking Water
 - Irrigation
 - Hydro-power
 - Navigation
 - Industrial and other uses.
- Water resource development projects should be planned and developed as multi-purpose projects. The projects should provide for irrigation, flood mitigation, hydro-electric power generation, navigation, pisciculture and recreation wherever possible. Drinking water would be the prime consideration. Recycling and re-use of water be an integral part of water resource development.
- Resource planning has to be for a hydrological unit such as a drainage basin as a whole or a sub-basin. Water zoning for use and economic development would be undertaken.
- Water development projects would consider impacts on human lives, settlements, occupations, economic, social and other aspects.
- Water management issues relating to agriculture, particularly with reference to irrigation systems- their management and efficiency and also at costs.
- There would be an integrated and multi-disciplinary approach to the planning, formulation and approval and implementation of water related projects, including catchment treatment and management, environmental and ecological aspects, rehabilitation of affected people, and command area development. Measures for minimising land erosion would be taken up.
- Groundwater potential would be assessed and exploited keeping its recharge potential in view.
- Water rates would ensure to cover costs of O&M. Due regard would be given to small and marginal farmers.
- Water quality would be monitored.
- Drought-prone areas would have special water conservation measures. The needs of drought-prone areas would be given priority in water resource development projects. Drought proofing methods would be given special attention.

6.2.2 National Land Use Policy Outlines, 1988

The policy outlines have been prepared. This document takes into account the environmental, social, demographic, economic and legal issues. The Policy has been circulated to all concerned for adoption and implementation through enactment of suitable legislation. The policy, however, did not make the desired

impact, mainly due to the fragmented handling of different components of agriculture like land and soil. However, a Land Resource Management Policy and Approach now is being finalised in consultation with FAO, the Lal Bahadur Shastri National Academy of Administration and the National Institute of Rural Development (NIRD). The policy is intended to have dynamic conservation, sustainable development and equitable access to the benefits of intervention as its thrust. Land being a State subject, many States have enacted legislation on land. The basic objectives of the National Land Use Policy: Outline and Action Points is given in Box 6.1

Box 6.1 Objectives of The National Land Use Policy: Outline and Action Points (1988)

1. To meet the consumption needs of a growing population by increasing productivity of the integrated land resource of the country.
2. To prevent any further deterioration of land resource by appropriate preventive measure.
3. To restore the productivity of degraded land by appropriate package of practices.
4. To provide the necessary technological and extension support to all concerned and to the farming community in particular for obtaining maximum production through increased productivity.
5. To allocate land for different uses based upon land capability, land productivity and National production goals.
6. To install an efficient and effective administrative structure for prescribing and regulating land by all concerned, including the government department and to revitalise the land use boards in this respect.
7. To involve the community for adoption of appropriate land use for increased productivity, by ensuring that the land use policy provides adequately for the consumption and energy needs and generally improves their income levels and provides them a better quality of life.
8. To create greater awareness of advantages of national land use policy at all levels through appropriate educational, extension and training programmes.
9. To restructure the livestock production programme in such a manner that the livestock population is gradually limited to economically productive stock and to prevent degradation of grassland by promoting measures of increasing stall feeding of livestock in rural areas.
10. To provide for optimum use of land under agriculture by promoting mixed farming systems in which the production programme will include the production of fodder and tree crops also on marginal and sub-marginal farm land.
11. To motivate farmers by organising input supplies and marketing support for encouraging them to cultivate the appropriate crop or fodder or trees in conformity with the land use policy.
12. To take up on priority basis the completion of land and soil surveys and to complete the inventory of land resources on the basis of the prescribed land use classification so that allocation is based on a reliable database.
13. To examine the legal support available for enforcement of land use policy in the form of existing State and central laws and to consider the need for comprehensive legislation to provide some teeth to any machinery entrusted with implementation of the national land use policy.

14. To co-ordinate the formulation and implementation of water resource management policies, forest management policies and urban planning within the overall resource allocation needs dictated by a comprehensive national land use policy.
15. To prepare a plan of action at all levels covering a time frame relevant to all the objectives specified above and to continuously monitor action taken thereon in all effective fashion.

6.2.3 National Forest Policy (NFP) of 1988

The National Forest Policy, 1988 envisages for the massive need-based and time-bound programme of afforestation and tree planting with particular emphasis on fuelwood and fodder development, on all degraded and denuded lands in the country (NFAP, MOEF, GOI, 1999). The Policy also makes it necessary to encourage planting of trees alongside of roads, railway lines, rivers, streams and canals, and other unutilised land and State/corporate/village and community lands and institutional or private ownership. It also provides that green belts and woodlots should be raised in urban/industrial areas as well as in arid tracts to check erosion and desertification as well as to improve the micro-climate.

Box. 6.2 Main Objectives of the National Forest Policy 1988

- Increasing substantially the forest/tree cover in the country through massive afforestation.
- Increasing productivity of forests.
- Meeting the requirements of fuelwood, fodder, minor forest produce and small timber and bamboo of the rural and tribal population.
- Efficient utilisation of forest resources.
- Conservation of the natural resources which is a heritage.
- Involving people through massive people' movement.
- Checking soil erosion.
- Checking the extension of sand dunes.

The National Forest Policy, 1988 recognised 'environment stability' to be the main objective of forest policy and the 'derivation of direct economic benefits' subject to this main objective. It took cognizance of basic needs of fuelwood, fodder, minor forest produce and construction timber of the tribal and poor and accepted these as the first charge on forest. The NFP, 1988 further states that one of the essentials of forest management is increasing forest cover on semi-arid, arid, and desert tracts. It called for involvement of people in protection, regeneration and development of forests. In these respects NFP, 1988 marked a paradigm shift in the objective of forest policy and forest management.

6.2.4 National Policy on Education (NPE) 1986 as Revised in 1992

The policy as revised in 1992 recognises the paramount need for creating consciousness of the environment and stipulates that it must permeate all ages and all sections of society, beginning with the child. Environmental consciousness should inform teaching in the schools and colleges. The policy seeks to integrate this aspect in the entire educational process. The policy envisaged that education should be used as a

strategy for achieving a basic change in the status of women. Important aspects include: (i) special focus on promotion of literacy amongst women and people from the backward communities, (ii) emphasis on vocational and skill development programmes, (iii) encouraging active participation of elected representatives at the *panchayat* level in the Adult Literacy Programmes. A Programme of Action was prepared with the assistance of 23 Task Forces.

6.2.5 Policy Statement of Abatement of Pollution, 1992

Advocates the use of a mix of instruments in the form of legislation and regulation, fiscal incentives, voluntary agreements, educational programmes and information campaigns for the prevention, control and abatement of environmental pollution in the country. The Policy is based on "Polluter Pays Principle".

Box. 6.3 Policy on Abatement of Pollution - Key elements

- Comprehensive approach to integrate environmental and economic aspects in development planning.
- Emphasis on preventive aspects.
- Promotion of technological inputs to reduce industrial pollutants.
- Encourage, develop and apply the best available practical technical solutions.
- Ensures that polluter pays for the pollution control arrangements.
- Involve the public in decision making.

6.2.6 National Livestock Policy Perspective, 1996. Presents a strategic framework with six identified thrust areas, as given below:

- (1) Use national and global market pull creatively to provide the energy and impetus for sectoral growth.
- (2) Enhance quality and economic efficiency at the sector level through promotion of appropriate institutions and mechanisms.
- (3) Use positive discrimination to support livelihood-intensive institutions, technologies and programmes so that future growth of livestock sector does not occur at the cost of rural livelihoods.
- (4) Redesign and revitalise the research establishment, extension and input supply mechanism to serve as the protective armour around small producers and women.
- (5) Promote research, experimentation, propagation of intermediate production units that blend advanced techniques with traditional modes of production.
- (6) Monitor environmental implications of the livestock sector growth and evolve participatory local mechanisms for CPRs management.

The goals of the policy perspective are (i) to transform the national and global market pull into an engine for generating sectoral and national competitive advantage, (ii) to enable small producers all over the country to participate in the process growth and globalisation and (iii) to ensure the ecological sustainability of the growth of the livestock sector. The strategy includes providing credit support to landless to own bullocks under the anti-poverty programmes. It also promotes programmes like Joint Forest Management, community fodder farms and grazing land protection committees as a method of sustainable use of village CPRs. It recommends the conservation of livestock germplasm in order to preserve genetic diversity. The Policy perspective also mentions the issue of feed and fodder requirements of the large and growing cattle population in the country.

The National Livestock Policy is in the process of being finalised (Ministry of Agriculture, Department of Animal Husbandry and Dairying, 2001).

6.2.7 National Agricultural Policy 2000

It seeks to promote technically sound, economically viable, environmentally non-degrading, and socially acceptable use of country's natural resources – land, water, and genetic endowment – to promote sustainable development of agriculture. The policy, particularly emphasises integrated and holistic development of rainfed areas by conservation of rain water by vegetative measures on watershed basis and augmentation of biomass production, for maintenance of ecological balance and for higher income generation through agro and farm forestry with the involvement of the watershed community and by evolving technology, extension and credit support packages. It, *inter alia*, indicates the broad policy framework for management of grazing land for increasing availability of animal feed and fodder, promoting use of unutilised wastelands for agriculture and afforestation, reclamation of degraded and fallow lands as well as problem soils for optimisation of their productive use; generation and transfer of technology; improving input use efficiency; pooling and evaluating traditional practices, knowledge and wisdom; promoting investments in agriculture, strengthening institutional infrastructure, ensuring better risk management and introducing management reforms, to achieve the objectives (MOA, 2000).

6.2.8 National Population Policy, 2000

The policy, while continuing with the two-child norm, takes a comprehensive look at issues determining population growth. Health care of mother and child, health and sanitation as well as compulsory education figure high on its agenda. It aims to achieve reduced population growth through decentralised decision-making. The policy aims at achieving a stable population by 2045. The new policy is significant that it has been endorsed at the highest level, which should generate the political will to carry forward a programme that is already in place. The policy has taken shape through a series of consultations with all stakeholders - the State Health and Family Welfare ministries, State Secretaries, professional medical associations, and medical experts, NGOs, media persons, corporate sector and the civil society towards advocacy and dissemination of the Policy. The Policy also focuses attention on the States of Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan, and Orissa involving voluntary associations, community organisations and the *Panchayati Raj* institutions. As a follow-up State Population Commissions have been set up in 10 States.

6.2.9 National Land Reforms Policy

Since land is under exclusive legislative and administrative jurisdiction of the States as per the VIIth Schedule of the Constitution, GOI play an advisory and co-ordinating role in the field of land reforms. It allows, *inter alia*, greater access to land by the landless rural poor and provides guidelines for introduction of land reform legislation or amendments to be initiated by the States and Union Territories (MORA&E, 1998).

6.2.10 Draft Policies: The Government had separately initiated the formulation of national policies on the following areas:

Draft Grazing and Livestock Management Policy, 1994

Draft National Policy for Common Property Resource Lands (CPRLs).

However, these have not been given final shape so far. The underlying issues therein are discussed in detail in Chapter 9.

6.2.11 Policy on Drought

There is no separate policy on drought per se. However individual ministries/sectors such as agriculture, water, forestry, livestock management, etc., have addressed the issue of drought management in their respective sectors.

6.3 Strategies for Environmental Conservation

Environmental management is accepted as a major guiding factor for national development. For this purpose, instruments such as suitable legislation, fiscal incentives, agreement and treaties, educational programmes and information dissemination through publicity are used. The strategy includes not only use of modern science and new technology, but also traditional technology with active involvement of the people.

6.3.1 National Conservation Strategy and Policy Statement on Environment and Development, 1992

In line with principles 16 and 17 of Agenda 21, the Government of India, Ministry of Environment and Forests adopted the National Conservation Strategy and Policy Statement on Environment and Development in June 1992. It lays down the guidelines that help to weave environmental considerations into the fabric of the national planning and development processes (MOEF, 1992). Policy prepared with a view to integrating environmental considerations into our development process. Emphasises sustainable life styles and proper management and conservation of resources.

The conservation strategy is to serve as management guides for integrating environmental concerns with development imperatives. The primary purpose of the strategy and policy statement is to reinforce the traditional ethos and to build up conservation consciousness in society, which would live in harmony with nature and make efficient use of resources. The strategy and policy statement lays down *inter alia* comprehensive action points in respect of sectors such as agriculture, irrigation, animal husbandry, forestry, energy generation, use and conservation, industrial development, mining and quarrying, tourism, transportation and human settlements to ensure that conservation and enhancement of the environment is taken due care of while achieving sustainable development. The strategy was presented as the framework of sustainable development for the country in the Earth Summit held at Rio in 1992.

6.3.2 National Policy and Macro-level Strategy and Action Plan on Biodiversity, 2000 focuses on the following goals:

- Conservation and sustainable use of biological diversity through consolidating ongoing efforts and initiating new steps, wherever necessary. This would include regeneration and rehabilitation of threatened species.
- Secure participation of all stakeholders including local people, NGOs, industry and others in the conservation and sustainable use of biodiversity.
- Realise consumptive and non-consumptive value of biodiversity through necessary investments in research and development including biotechnology development.

- Ensure benefits to India as country of origin of biological resources and to local communities and people as conservationists of biodiversity, creators and holders of indigenous knowledge, innovations and practices.
- Ensure consideration and integration of biodiversity concerns in other sectoral policies and programmes.

6.4 Legislative Framework

6.4.1 Forest (Conservation) Act, 1980

The Forest (Protection) Act was enacted with a view to checking indiscriminate diversion of forest land for non-forestry purposes. Under this Act, compensatory afforestation is necessary and approval from the Central Government is required before any forestland is diverted for non-forestry purposes. Moreover, transfer is allowed only with the provision that compensatory plantations in an equivalent area of non-forest land, or double the area in degraded forestland are raised. It should be noted that, since forestlands are owned by State, approval is a matter between the Central and State Governments.

Important guidelines laid down in Forest (Conservation) Act, 1980 and Rules for diversion of forest land for non-forest purposes include:

- At the initial stage of the proposal different impacts to the environment of the area needs to be addressed.
- The guidelines specify certain criteria for the siting of an industry, which state that no projects should be in the vicinity of:
 - National parks, wildlife sanctuaries and core areas of biosphere reserves.
 - Areas of geomorphologic significance, unique biomass and ecosystems, heritage sites/structures and areas of cultural heritage and importance.
 - Protection of fragile ecosystems.
 - Areas rich in biodiversity, gene pool and other natural resources.
- Investors in industrial projects involving forest land are required to undertake a detailed Environmental Impact Assessment (EIA) study of their project with respect to physical resources, hydrology and water quality, socio-economic aspects, human use values, etc.

6.4.2 Environment (Protection) Act, 1986

A comprehensive act for the conservation and protection of the environment of the country. It is a Central Act empowering the Central Government to:

- Take all necessary measures for protecting the quality of environment.
- Plan and execute nation-wide programmes for the prevention, control and abatement of environment pollution.
- Lay down standards for discharge of environmental pollutants and for quality of environment.
- Restrict areas in which industry, operation, process may not be carried out or shall be carried out subject to certain safeguards.
- Lay down procedures and safeguards for handling hazardous substances.
- Issue directions to any person, officer, or authority including the power to direct closure, prohibition.

- Regulate any industry, operation or process or stoppage or regulation of supply of electricity, water or any other service.

6.4.3 Water (Prevention & Control of Pollution) Act, 1974 as amended in 1988

Deals with issues for the prevention, control and abatement of water pollution in the country. Water polluting industries are required, under the Act, to obtain consent from Pollution Control Boards set up in every State for the purpose of taking appropriate measures to prevent and control pollution from effluents.

6.4.4 Wildlife (Protection), 1972 as amended in 1988

Provides for the conservation of wildlife in the country.

6.4.5 Constitutional Amendments (73rd and 74th Amendments) of 1992

The Constitution of India was amended in 1992 to provide more powers to the local self governments on a number of areas of governance.

Panchayat Raj Act, 1992 (Seventy Third Amendment Act)

This gives land related subjects to the *Panchayati Raj* institutions (Local Self Governments) at the village, block and district levels.

- This is to ensure participatory planning, decision making, and monitoring of programmes by the local self governments.
- Programmes relating to agriculture, land consolidation and soil conservation, water management and watershed development, animal husbandry, fuel wood and fodder, social forestry, etc., are being implemented through these institutions.

The Act provides that:

- There shall be a Panchayat (Institution of self-governance) constituted under Article 243-B for the rural areas in every State at the village, and district levels.
- The Panchayat shall be constituted by a Chairperson and members who are elected representatives of that village they represent.
- Seats shall be reserved for the backward socially deprived communities (SC/ST).
- Not less than one-third of the seats shall be reserved for women and also for those belonging to SC/ST.
- The powers include preparation of plans for economic development and social justice.
- The implementation of schemes for economic development and social justice pertain to matter listed in the 11th schedule (Article 243-G).

Box. 6.4 Matters Listed in the Eleventh schedule

11th Schedule -(Article 243-G)

- Agriculture including agricultural extension.
- Land improvement, implementation of land reforms, land consolidation and soil conservation.
- Minor irrigation, water management and watershed development.
- Animal husbandry, dairying and poultry.

- Fisheries.
- Social forestry and farm forestry.
- Minor forest produce.
- Small-scale industries including food processing industries.
- Khadi, village and cottage industries.
- Rural Housing.
- Drinking water.
- Fuel and fodder.
- Roads, culverts, bridges, ferries, waterways and other means of communication.
- non-conventional energy sources.

Municipality Act, 1992 (74th Amendment Act, 1992)

The Act provides that Municipalities be constituted in every State (based on population, density of population, revenue generation, for local administration, percentage of employment in non-agricultural activities, economic importance, etc :

- Nagar Panchayat
- A Municipal Council for a smaller urban area
- A Municipal Corporation for a larger urban area.

The Municipality Act enables them to function as institutions of self governments for devolution of powers and responsibilities with respect to:

- preparation of plans for economic development and social justice
- Performance of functions and implementation of schemes as may be entrusted to them including those in relation to the matters listed in the Twelfth Schedule.

Box. 6.5 TWELFTH SCHEDULE (Article 243-W)

1. Urban planning, including town planning.
2. Regulation of land-use and construction of buildings.
3. Planning for economic and social development.
4. Roads and bridges.
5. Water supply for domestic, industrial and commercial purposes.
6. Public health, sanitation, conservancy and solid waste management.
7. Fire services.
8. Urban forestry, protection of the environment and promotion of ecological aspects.
9. Safeguarding the interests of weaker sections of society, including the handicapped and mentally retarded.
10. Slum improvement and upgradation.
11. Urban poverty alleviation.
12. Provision of urban amenities and facilities such as parks, gardens, playgrounds.
13. Promotion of cultural, educational and aesthetic aspects.
14. Burials and burial grounds, cremations, cremation grounds and electric crematoria.
15. Cattle ponds, prevention of cruelty to animals.
16. Vital statistics including registration of births and deaths.
17. Public amenities, including street lighting, parking lots, bus stops and public conveniences.
18. Regulation of slaughter houses and tanneries.

6.4.6. Biodiversity Bill, 2001: A Bill for conservation of biodiversity in the country has been introduced in the Parliament.

B. PLANNING, PROGRAMMES AND INSTITUTIONAL FRAMEWORK

6.5 Planning

Structure: The Planning Commission was set up in 1950 by a Resolution of the Government of India and is responsible for planning for the country. The National Development Council (NDC), which is headed by the Prime Minister and consists of the Central Cabinet Ministers and all the State Chief Ministers, guides the planning process. The purpose of planning is to ensure growth, self-reliance, modernisation and social justice. State Level Planning Boards have also been set up by respective States. The Plan process is normally undertaken for five-years. So far, eight Five-year Plans have been prepared and implemented. The on-going 9th Five-Year Plan is for the period 1997-2002. The Planning Commission consults the Central Ministries and the State Governments while formulating Five-Year Plans and Annual Plans and also oversees its implementation. The Commission also functions as an advisory body at the apex level. The evolution of the five-year plans to changing objectives and needs is presented in Annex 5 and summarised in Tables 6.1, 6.2 and 6.3.

Table 6.1: Summary of the Major Activities/Events in the Various Five-Year Plans

Five Year Plan	Year	Major Schemes/Measures Introduced for Combating Desertification
First	1951-1956	Agriculture central to the economy.
Second	1956-1961	Industrialisation, in addition to agriculture got emphasis. Planning on socialist pattern of economic development.
Third	1961-1966	Continued with the socialist pattern of development. Setback due to drought, external conflicts and devaluation of the rupee.
	1966-1969	Beginning of 'Green Revolution'- Steep increase in agricultural output with a combined use of new varieties of seeds, fertilisers, and pesticides.
Fourth	1969-1974	Environment as an issue was realised and resulted in the setting of the National Committee on Environmental Planning and Coordination (NCPEC). In agriculture, increased use of High-yielding varieties.
Fifth	1974-1979	Problems of Inflation and BOP due to steep rise in prices of imported oil.
Sixth	1980-85	Constitution of the Department of Environment. Land degradation issues also received attention with the setting up of the National Wastelands Development Board (NWDB).
Seventh	1985-90	Animal husbandry programmes given focus and the success of "Operation Flood Project" for meeting country's milk and milk product needs.
	1990-91	Major restructuring of the Economic Policy. Process of economic reforms and liberalisation measures initiated. Planning redefined from a highly centralised planning to indicative planning.
Eighth	1992-1997	Role of Planning redefined to achieve goals of sustainable development. Human development identified as crucial to sustainable development. A number of employment generation schemes launched in the rural sector. Health related programmes also received greater attention. Launch of the National Drinking Water Mission. Setting up of the National Afforestation Board.
Ninth	1997-2002	Greater integration of human development programmes with environmental, health and local development programmes. Further process of economic reforms in many sectors.
Tenth	2002-2007	Under formulation.

Table 6.2: Summary of Five-Year Plan Allocation for the Major Sectors (in Rs. Crores)

S.N	FIVE YEAR PLANS	1ST		2ND		3RD		4TH		5TH		6TH		7TH		8TH		9Th	
		Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%
1.	Agriculture & Minor Irrigation	299 (incl. comm.dev)	14.8	320	6.9	625	8.6	4017	16.4	4643.6		5695.07	5.84	10573.62	5.87	54992.5	12.69	37546	4.4
2.	Irrigation & Flood Control	585 (incl. Power)	29.1					964	3.95	3440.1		12160.03+	12.47	16978.65	9.43			55598	6.5
3.	Major & Medium Irrigation			450	9.8	650	9.0												
4.	Energy									7293.9		26535.44	27.21	54821.26	30.45	115561.1	26.6	21554	25.1
5.	Power			410	8.9	925	12.8	2135	8.75										
6.	Community Development & Coop.			210	4.6	400	5.5												
7.	Village & Small Industries			180	3.9	250	3.4	795	3.25										
8.	Industry & Minerals	100	5.0	880	19.1	1500	20.7	5240	21.4	10200.6		15017.57	15.4	22460.83	12.48	46921.7	10.8	69972	8.1
9.	Transport & Communications	532	26.4	1290	28.1	1450	20.0	4183	17.1	6881.4		2411.97+	2.47+	22971.02	12.76	5592557	12.88	121324	14.1
10.	Scientific Research							134	0.55			3134.26	3.21	+6472.46	+ 3.6	+25109	+ 5.78	+47616	+ 5.5
11.	Science & Technology (including Environ.)											865.20	0.88	2466.00	1.37	4131.71®	0.95	25529®	3.0
12.	Ecology & Environment															4909.98	1.13	25529	3.0
13.	Social Services **	423	21.0	860	18.7	1250	17.2			4766.77				29350.46	16.31	79011.90	18.20	182005	21.2
14.	Health							437	1.79			1821.05	1.86						
15.	Family Planning							300	1.23			1010.00	1.03						
16.	Nutrition											238.14							
17.	Education							852	3.49	1284.29		2523.74							
18.	Water Supply & Sanitation							339	1.39			3922.02							
19.	Housing & Urban Development							2851	11.6			1490.87 & 997.53	1.53& & 1.02						
20.	Rural Development											5363.73	5.50	9074.22	5.04	34425.36	7.93	73439	7.9
21.	Welfare of Backward Classes							134	0.55			1560.30	0.98						
22.	Social Welfare							37	0.15			271.97	0.28						
23.	Labour Welfare & Craftsman training							37	0.15			199.64	0.20						

S.N	FIVE YEAR PLANS	1ST		2ND		3RD		4TH		5TH		6TH		7TH		8TH		9Th	
		Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%	Total Outlay	%
24.	Other Programmes							183	0.75			801.47	0.82	1686.79	0.94				
25.	Special Areas Programmes\$									450.0		1480.00		3144.69	1.75	6750.16	1.55	3649	0.4
26.	Gen. Eco. Services																		
27.	Gen.Services															6360#	1.47	11940	1.4
28.	Others *	74	3.7	-	-	200	2.8	1760	7.21	326.7				1686.79	0.94				
29.	GRAND TOTAL	1960	100	4600	100	7250	100	24398	100	39287	100	97500	100	180000	100	434100	100	859200	100

@ Does not include Ecology & Environment for which allocation is under a separate Head.

Includes both Gen. Economic services & Gen. Services

* Includes Inventories & Other Programmes

\$ Includes DDP and DPAP

+ Includes Major and Medium Irrigation projects

** Social Services includes: Education, Health, Family Planning, Nutrition, Housing, Urban Dev., Water Supply & Sanitation, Social Welfare

Source: Reports of the Five-Year Plans of the Planning Commission, Government of India.

Table 6.3: Growth Performance in the Five-Year Plans

S.N.	Five Year Plan	Growth Rate	
		Target	Actual
1.	First (1951-56)	2.1	3.61
2.	Second (1956-61)	4.5	4.27
3.	Third (1961-66)	5.6	2.84
4.	Fourth (1969-74)	5.7	3.30
5.	Fifth (1975-1980)	4.4	4.80
6.	Sixth (1980-85)	5.2	5.66
7.	Seventh (1985-90)	5.0	6.01
8.	Eighth (1992-97)	5.6	6.78
9.	Ninth (1997-2002)	6.5	5.8*

Source: Ninth Plan (1997-2002) Document, Vol.I, Planning Commission, GOI.

* As per latest (2001) projections of the Planning Commission

6.6. Institutional Framework

6.6.1 Institutional Framework at the Central Level

As part of the process of formulation and implementation of the Five Year Plans (see section 6.5), the Government has formulated a number of policies (see section 6.2) and has enacted several legislation (see section 6.4) to ensure proper conservation and management of natural resources. The section below explains, in brief, the role played by key ministries and departments and a number of R&D and autonomous organisations functioning in the Central Government which have a direct role to protect land resources and to combat desertification.

6.6.1.1 Ministry of Environment and Forests (MOEF): The Ministry of Environment and Forests (MOEF) is responsible for planning, promoting and co-ordinating the environmental and forestry programmes in the country. The Ministry also undertakes activities for the conservation of natural resources, afforestation and regeneration of degraded areas, impact assessment, forest conservation, research, environmental education and information. In the framework of sustainable development, a number of guidelines have been prepared for major development projects concerning energy, infrastructure, transportation, etc which take into account impact assessment of the project and suitable measures for conservation of environment.

6.2.1.2 Ministry of Rural Development (MORD): The Ministry consists of three Departments - **Department of Rural Development, Department of Land Resources, and the Department of Drinking Water Supply.** The Ministry of Rural Development is responsible for the development and implementation of the rural-based schemes, which provide with avenues of employment and income generation, development of rural infrastructure and implementation of schemes on a watershed basis. The Ministry also implements special poverty alleviation programmes and schemes targeting the rural poor. The erstwhile Ministry of Rural Development was renamed as the Ministry of Rural Areas and Employment vide notification dated 8th March 1995. In view of the multiplicity of problems relating to soil and land resources the Department of Wasteland

Development was reconstituted as the Department of Land Resources in April 1999 with additional mandates of Land Reforms, Land Administration including Land legislation, Drought Prone Area Programme (DPAP), Desert Development Programme (DDP), etc. The other mandate of the Department of Land Resources include rehabilitating the degraded lands (wastelands) into sustainable productive use by involving the people, concerned Central/State level machinery and also *Panchayati Raj* Institutions (Government of India 2000d).

6.6.1.3 Ministry of Agriculture (MOA): The Ministry of Agriculture comprises of **Department of Agriculture and Cooperation (DAC), the Department of Animal Husbandry and Dairying, the Department of Agricultural Research and Education (DARE) and the Department of Food Processing Industries.** The Indian Council of Agricultural Research is under the DARE. The DAC is responsible for the formulation and implementation of National Policies and programmes aimed at achieving rapid agricultural growth through optimum utilisation of the country's land, water, soil and plant resources. The Department undertakes measures to ensure timely and adequate supply of inputs and services such as fertilisers, seeds, pesticides, agricultural implements, and also to provide agricultural credit, crop insurance and ensure remunerative returns to the farmer. The Department is entrusted with the responsibility for collection and maintenance of a wide range of statistical and economic data relating to agriculture, land use and land degradation, required for development planning, organising agricultural census, assisting and advising the States in undertaking scarcity relief measures and in management of natural calamities/disasters, e.g., drought, flood, cyclone, etc. through the a separate Division for Natural Disaster Management.

6.6.1.4 Ministry of Water Resources (MOWR): The Ministry of Water Resources (MOWR) of the Central Government is responsible for the overall planning, policy formulation, coordination and guidance in the water resources sector. The Ministry provides technical guidance, scrutiny, clearance, and monitoring of irrigation, flood control and multipurpose projects (major/medium) of the States. It is also responsible for the overall policy formulation, planning and guidance in respect of minor irrigation and command area development. The Ministry also undertakes overall planning for the development of ground water resources, establishment of utilisable resources and formulation of policies for exploitation, overseeing of and support to the State level activities in ground water development. The ministry formulates the national water resources development perspective and determines the water balance of different basins/sub-basins for possible inter-basin transfers. The Ministry also takes the role of coordination, mediation and facilitation in regard to resolution of differences or disputes relating to inter-State rivers and overseeing the implementation of Inter-State projects. Another important responsibility is to negotiate with neighbouring countries such as Bangladesh, Nepal and Pakistan with regard to river waters, water resources development projects and the operation of the Indus Valley Treaty.

6.6.1.5 Ministry of Human Resource Development: Has two major Departments - **Department of Education and Department of Women and Child Development.** The Department of Education primarily is responsible for both formal and non-formal education in the country - policy, programmes and for recommending measures for achieving full literacy in the country. The Department of Women and Child Development, which was earlier with the Department of Youth, Sports Affairs, Women & Child Development, has now been re-established as a full-fledged Department under the Ministry.

6.6.1.6. Other Ministries

Ministry of Social Justice and Empowerment: Focusing on economic and social upliftment of the backward communities.

Ministry of Small Scale, Agro and Rural Industries: Has been created to help the small scale sector cope with the emerging challenge of globalisation. A High-Powered Committee has been set up for recommending single comprehensive legislation for small-scale industrial (SSI) units. Also to recommend a mechanism for participation of SSI associations and NGOs in the small and village enterprises development programmes. The Ministry is also looking into strengthening the credit delivery system to assist SSIs. A Modernisation plan and rationalisation of the fiscal regime of the SSIs to make them competitive in the global market is also under implementation.

Ministry of Science & Technology (MS&T): For development and promotion of science and technology.

Ministry of Non-Conventional Energy Sources (MNES): For development and promotion of non-conventional energy sources in the country.

Ministry of Health and Family Welfare (MOH & FW): The Ministry has two main Departments - Department of Health and Department of Family Welfare.

There are a number of ministries which are related to growth and strengthening of sectors relating to **energy, infrastructure (transport, power, communication, Information technology), finance** which play a direct and significant role in the country's development process and economic growth.

6.6.1.7 Establishment of the NAEB, NWDB and the NLCB

The implementation of various programmes, schemes measures and activities for the conservation of natural resources and for addressing land degradation have also been through the establishment of national and state level land-use Boards (SLUBs) which have been set up under the Ministries of Agriculture, Rural Development and of Environment and Forests. These are the **National Land Use and Wastelands Development Council (NLWC), the National Wastelands Development Board (NWDB) and the National Afforestation and Ecodevelopment Board (NAEB)** respectively.

Table 6.4: Functions of NLCB, NWDB and NAEB

<p>National Land-Use and Conservation Board is chaired by Union Minister of Agriculture.</p>	<p>Formulation & implementation of a national land use policy. Concerned with conservation & optimal utilisation of the land resources. Guidelines and financial support to State Land Use Boards (SLUBs).</p>
<p>National Wastelands Development Board, (NWDB), MORD. (Chaired by Union Minister for Rural Development)</p>	<p>Set up in 1985 in the MOEF and presently functioning under the Department of Land Resources under the Ministry of Rural Development. Development of wastelands in the country to sustainable use and increasing biomass available, especially fuel wood & fodder.</p>
<p>National Afforestation & Eco-Development Board, (NAEB), MOEF, is chaired by Union Minister of Environment and Forests.</p>	<p>Set up in 1992 in MOEF. Promotion of afforestation, trees planting, ecological restoration, & eco-development activities in the country. Regeneration of degraded forest areas and land adjoining the forest areas, national parks, sanctuaries & other protected areas and ecologically fragile areas.</p>

The National Land Use and Wastelands Development Council (NLWC) set up in 1985 is the highest policy planning and co-ordinating agency for all issues concerning the country's land resources. The Prime Minister of India is the Chairman of the Council. The MOA oversees and co-ordinates the work of the National Land-Use and Conservation Board (NLCB) and the SLUBs, the MORD - the National Wastelands Development Board (NWDB), and the MOEF the National Afforestation and Eco-Development Board (NAEB). The functions of the three Boards are given in Table 6.4.

The State Governments have their own departments to specifically look after areas such as rural development, agriculture, water resources/irrigation, animal husbandry, forests and environment, etc. State Land Use Boards (SLUBs) under the Chairmanship of Chief Minister are responsible for co-ordination and implementation of related Central/State schemes and programmes.

6.6.1.8. Establishment of the NRCD, CGWA, CGWB , CWC, CADA and the CPCB:

The Government of India had in 1985 set up a Central Ganga Authority under the Ministry of Environment and Forests in 1985 with a view to cleaning up the Ganges. The CGA was upgraded to constitute the **National River Conservation Directorate (NRCD)** to take up the cleaning of the most polluted river stretches in the major rivers in the country. The NRCD was given additional functions of improving the 14 lake ecosystems, especially the lake water quality. **The Central Pollution Control Board (CPCB)** is a Central Level organisation under the Ministry of Environment and Forests and is responsible for overseeing the activities for prevention, control and abatement of environmental quality. The CPCB has prepared water quality atlases for all the rivers and river basins in the country and is responsible for monitoring of the water quality and for recommending suitable preventive and abatement measures for their improvement and good quality. State Pollution Control Boards (SPCBs) function at the State level.

The **Central Water Commission (CWC)** has carried out basin-wise detailed appraisal of water potential in the major river basins in the country. The **Central Ground Water Board (CGWB)** under the Ministry of Water Resources is responsible for carrying out nation-wide surveys and assessments of ground water resources through a network of 15,000 stations in the country. The CGWB is also responsible for guiding the States appropriately in scientific and technical matters relating to groundwater. In drought prone and desert areas, ground water is perhaps the only source of water supply which can be harnessed for safe water supply to the people living in difficult and most vulnerable situations. The Board organises intensive surveys and exploration programmes to delineate aquifers, which could provide sustainable supply of water during periods of prolonged droughts. Ground water exploration is also under way in drought prone areas in the States of Uttar Pradesh, Andhra Pradesh, Rajasthan, Maharashtra, Madhya Pradesh, Orissa, Karnataka, and Gujarat. The **Central Ground Water Authority (CGWA.)** set up under the provisions of the Environment (Protection) Act, 1986 is a regulatory authority on the utilisation of ground water in the country. The **Command Area Development Authority (CADA)** is responsible for the development and management of the command areas. The CWC, CGWB, CGWA and the CADA are with the Ministry of Water Resources.

6.6.2 Institutional Framework at the Local Level

Rural development and poverty alleviation programmes are implemented on a decentralised basis throughout the country. There are a number of Project Implementing Agencies (PIAs) at the local level. These include: the District Watershed Committees, the District Rural Development Agencies, the District Forest Officers, and the *Panchayati Raj* institutions. The governing body of the DRDA include Members of Parlia-

ment (MPs), Members of Legislative Assembly (MLAs), District level officers of the Development Departments and representatives of the weaker sections of the society. At the block level, the Block Development Officer and at the village level- *Gram Sevak* or village level workers are responsible for implementation of the programme. The District Administrators (District Collectors) help in the overall administration of the area.

Watershed projects under the DDP, DPAP and the IWDP programmes are sanctioned in favour of the DRDAs/Zilla Parishads (ZPs) which are implemented by various line departments of the State Governments, NGOs, etc. as Project Implementing Agencies (PIAs). The Guidelines for Watershed Development provide for constitution of State Watershed Programme implementation and Review Committee at State level to coordinate and review the implementation of the watershed projects under the three schemes. Village Development Committees constitute Implementing agencies in areas such as Health, Agriculture, Village development, Infrastructure, etc. The *Krishi Vigyan Kendras* (KVKs) (Farm Science Centres) of the ICAR provide interface service to farmers in various areas such as: access to appropriate technology, awareness raising, dissemination of information, training, etc. In addition, the institutional structure of the government is supported by a large network of non-governmental organisations, institutions and agencies, which play a significant role in achieving the objectives pertaining to many of the programmes and schemes of the Government.

Table 6.5 Institutional Framework at Various Levels of Functioning given below:

LEVEL	INSTITUTIONAL FRAMEWORK
Central	Central Government - Ministries, Departments - Environment & Forests, Rural Development, Agriculture, Human Resource Development, Women and Child Development, Social Justice and Empowerment, Health and Family Welfare, Water Resources, etc. R&D Organisations and autonomous organisations of the Central Government - Central Ground Water Authority (CGWA), Central Ground Water Board (CGWB), Central Water Commission (CWC), Command Area Development Authority (CADA), Indian Council of Agricultural Research (ICAR), Indian Council for Forestry Education and Research, Central Pollution Control Board, NAEB, NLCB, NWDB, NRCD, etc.
State	Departments of Forests and Environment, Rural Development, Agriculture, Water Resources/Irrigation, Animal Husbandry, Social Welfare, etc. State level organisations such as State Land Use Boards (SLUBs), State Renewable Energy Development Agencies, State Pollution Control Boards (SPCBs) and State/Regional Centres of R&D and other institutions of the Government.
District	District Magistrates (DM), District Collectors (DCs), District Forest Officers (DFO), District Rural Development Agencies (DRDA), District Watershed Committees, District Social Welfare Officer (DSWO) Krishi Vigyan Kendras (KVKs), etc., Community Health Centres, etc. Regional/Zonal Centres of the Central and State Departments and Institutions.
Block] <i>Panchayati Raj</i> Institutions, Community Health Centres, Block Development Officers
Village (Panchayat)] <i>Panchayati Raj</i> Institutions - Gram <i>Panchayat</i> , Janpadh <i>Panchayat</i> , Zilla <i>Panchayat</i> , Gram Sabha (Village Council), Village Development Committees and Implementing Agencies.

6.6.3 Institutional Framework for Research and Development

Besides creating the institutional framework, formulation of policies and policy instruments, the Government of India has substantially augmented research efforts by strengthening the relevant National Research Institutions. Over the years, the research institutes in collaboration with State Agricultural Universities have been engaged in study and analysis of the problems of desertification and drought. The emphasis is on the development of appropriate and cost-effective technologies to combat desertification and drought and to increase the productivity of affected areas. In addition, the International Crop Research Institute for the

Semi-Arid Tropics (ICRISAT) at Hyderabad is intensively studying the resource conservation and management aspects in its Farming Systems Research. ICRISAT serves as a world centre to improve the genetic potential, yield and nutritional quality of sorghum, pearl millet, pigeon pea, chickpea and groundnut. Apart from the work of ICRISAT, other national institutes also study and analyse issues in desertification and drought. A brief outline of the work being done is given in Tables 6.6 & 6.7. These institutes serve as repositories of information in their respective fields and have excellent training facilities (Table 6.6.).

In addition, three All India Coordinated Projects of the Indian Council of Agricultural Research (ICAR) have been established; one on forage crops at Jhansi, the second on dry land farming at Hyderabad and the third on agroforestry at Jhansi. These projects, with a network of sub-centres in the arid and semi-arid regions of the country, have been established for conducting location-specific research on problems related to mitigating the effects of drought.

Table 6.6 - Research Institutes under the ICAR and Their Thrust Areas

Research Institutes	Thrust Areas (Basic and Applied Research)
Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad	Development of strategies for sustainable farming systems in rainfed areas.
Central Soil and Water Conservation Research and Training Institute, Dehradun.	Controlling degradation of soil through erosion and rehabilitation of degraded lands.
The National Bureau of Soil Survey and Land Use Planning (NBSS & LUP), Nagpur.	Inventorise and upgrade scientific information on the nature, extent and distribution of soils and associated climatic features.
Central Arid Zone Research Institute (CAZRI), Jodhpur	Repository of information on the state of natural resources and desertification process and its control. Development of sustainable farming systems.
National Research Centre on Agroforestry (NRCAF), Jhansi.	Evaluation and improvement of multipurpose tree species (MPTS) suitable for agroforestry; basic and applied research on all aspects of agroforestry.
Central Soil Salinity Research Institute (CSSRI), Karnal.	Development of strategies for salinity control and management of salt affected soil and use of poor quality water.
Indian Grassland and Fodder Research Institute, (IGFRI), Jhansi.	Forage crops and grassland management; sustain; enrich and enhance germplasm of these crops.
Sheep and Wool Research Institute (CSWRI), Awikanagar.	All disciplines relating to sheep and rabbit production; develop, update and standardised meat, fibre pelt technology.

India Meteorological Department (IMD)

Agro-Met. Services: A Meteorological Department on an all-India basis was set up by the Government of India in 1875, following the recommendation of the Commission of Enquiry into the Orissa and Bengal Famine of 1896. The IMD established an Agriculture Meteorological Division at Pune in 1932. Since then, it has been maintaining a network of Agromet observatories, across the country with the Cooperation of agricultural universities and research institutions. The Central Agrimet. Observatory at Pune and agrimet observatories at Bangalore, Anand and Rahuri have many specialised instruments and facilities for research. The Agr. Met.Division prepares crop weather calendars which depict State and stage of crop under normal weather conditions and weather elements detrimental to the crops in various growth stages. This

Division has also prepared an Agroclimatic Atlas of India and aridity anomaly maps.

Drought Research Unit of India Meteorological Department (IMD): The IMD has also set up a Drought Research Unit which monitors and assesses the agricultural drought in the country using certain indices based on rainfall data.

Prediction and monitoring of natural disasters: The IMD, in addition, is engaged in prediction and monitoring of natural disasters such as droughts and floods and for the study of district level droughts, using long series of meteorological data.

Research Institutions on the Forestry Sector

A network of research institutions under the Indian Council of Forestry Research and Education (ICFRE), Dehra Dun is addressing problems related to the development of suitable technologies for afforestation and improving forest productivity. These include the Arid Forest Research Institute, Jodhpur, Tropical Forest Research Institute, Jabalpur, and Institute of Forest Genetics and Tree Breeding, Coimbatore. The Centre for Environment Management of Degraded Ecosystem (CEMDE) under the Ministry of Environment and Forests has been working, *inter-alia*, on the technology development for prevention of dust-blow and slope stabilisation of dry fly ash mound – the Asia’s largest fly ash mound.

Table 6.7: Institutions of the MOEF Engaged in Education, Training and Information on Forestry and Wildlife Conservation

NAME OF INSTITUTION	ACTIVITIES
1. Indian Council of Forestry Research and Education (ICFRE), Dehradun	Organises and manages research, education and extension services in the field of forestry.
2. Indira Gandhi National Forest Academy (IGFNA), Dehradun	Imparting in-service training to Indian Forest Service officers on technical forestry and managerial aspects.
3. Directorate of Forest Education, Dehradun.	Is responsible for controlling and co-ordinating and managing all the regular courses of State Forest service and Forest Range Officers in the country.
4. Indian Plywood Industries Research and Training Institute (IPIRTI), Bangalore	As a centre for expertise in the mechanical wood industries technology sector and is equipped with modern facilities for research and training in saw milling and plywood.
5. Indian Institute of Forest Management, Bhopal (IIFM)	Provides training in management and related subjects to officers from the Indian Forest Service, forest departments, forest development corporation and forest related industries with a view to inculcating professionalism in forestry management.
6. Wildlife Institute of India (WII), Dehradun	Is to impart training to government and non-government personnel, to carry out research and training and advice matters of conservation and management of wildlife resources.
7. National Museum of Natural History, New Delhi with branches in Mysore and Bubaneswar	To promote non-formal environmental education, conservation and awareness among people through various in-house and out-reach activities.

Source: MOEF, Annual Report, 1999-2001

Table 6.8: Summary of List of R&D and Other Organisations and Institutions involved in Combating Desertification.

Area/Sector	Main Institutions	Universities/Other Institutions
Agriculture	Indian Council for Agricultural Research (ICAR), Central Soil & Water Conservation Research & Training Institute (CSWCRTI), Central Research Institute for Dryland Agriculture (CRIDA), National Research Centre for Agroforestry (NRCAF), Indian Grassland and Fodder Research Institute (IGFRI), Central Arid Zone Research Institute (CAZRI), Central Soil Salinity Research Institute (CSSRI)	ICRISAT, Agricultural Research Universities, CAPART, TERI, Krishi Vigyan Kendras (KVKs), NABARD
Forestry	Indian Council for Forestry Research & Education (ICFRE), Forest Research Institute (FRI), Arid Forest Research Institute (AFRI), Kerala Forest Research Institute (KFRI)	GB Pant Himalayan Development, Indian Institute of Forest management (IIFM), Bhopal, Indian Plywood Industries Research and training Institute (IPIRTI), Bangalore, Indira Gandhi National forest Academy (IGNFA), Dehradun, Directorate of Forestry Education, Dehradun, Wildlife Institute of India (WII), Dehradun, National Museum of Natural History (NMNH), New Delhi with zonal offices at Mysore, Bhopal and Bhubaneswar
Water Resources	National River Conservation Directorate (NRCD), Central Ground Water Authority (CGWA), Central Water Commission (CWC), Central Pollution Control Board (CPCB), Command Area Development Authority (CADA)	State level institutions of these organisations. Centre for Science and Environment (CSE)
Survey, Monitoring & Assessment	All India Soil and Landuse Survey (AISLUS), National Bureau of Soil Survey & Landuse Planning (NBSSLUP), Indian Space Research Organisation (ISRO), National Remote Sensing Agency (NRSA), Department of Space (DOS) centres, Space Application Centre (SAC), India Meteorological Department (IMD), National Atlas & Thematic Mapping Organisation (NATMO), National Medium Range Weather Forecasting Centre (NMRWFC)	
Energy		Tata Energy Research Institute (TERI), Council for People's Action for Rural Technology (CAPART), IREDA (Indian renewable Development Agency).
Rural Development	National Institute of Rural Development (NIRD)	State Institutes of Rural Development (SIRDs), Council for Advancement of People's Action & Rural Technology (CAPART), National Bank for Agriculture & Rural Development (NABARD)

6.7 Programmes for Combating Desertification

The programmes for combating desertification can be broadly classified under the following major areas:

- **Social sector programmes based on community and human development and particularly at the local level.**
- **Programmes specifically for poverty eradication.**
- **Programmes for conservation of natural resources.**
- **Programmes for eco-restoration of degraded lands.**

- **Programmes specially for desert and drought prone regions.**
- **Measures to combat and mitigate the effects of drought.**

The three major ministries which are concerned with formulation and implementation of programmes for conservation of natural resources and land development are: (i) the Ministry of Environment and Forests (MOEF), (ii) Ministry of Rural Development (MORD), and (iii) the Ministry of Agriculture. The major Central/Centrally Sponsored Sector Land-based Programmes under Implementation by Different Ministries are briefly explained below and summarised in Table 6.11.

SOCIAL SECTOR AND COMMUNITY DEVELOPMENT PROGRAMMES

6.7.1 Social Sector Programmes

In addition to land-based programmes described above, a variety of programmes/schemes in the social sector are being implemented by Department of Family Welfare, Department of Education, Department of Women and Child Development, Ministry of Social Justice and Empowerment, Ministry of Rural Development, etc. These programmes can be broadly divided in four main areas: (i) programmes for social awareness and security and empowerment of women and weaker sections of the society, and poverty eradication, (ii) programmes for infrastructure development and employment generation, (iii) programmes on health, nutrition, sanitation and safe drinking water, and (iv) programmes of literacy and pre-school. Notable amongst them are briefly explained below:

6.7.1.2. SCHEMES FOR WOMEN & CHILD DEVELOPMENT

(i) National Commission for Women: In January 1992, the Government set up this statutory body with a specific mandate to study and monitor all matters relating to the Constitutional and legal safeguards provided for women, review existing legislation to suggest amendments wherever necessary.

(ii) Representation of Women in Local Self Governments: The landmark initiative of the Government of India to promote gender equality even in the political sphere is the 73rd Constitutional amendment reserving one third elected seats for women in all *Panchyati Raj* Institutions. Through this measure, an estimated one million women could emerge as leader at the grass-root level in rural areas alone, with 75,000 of them being Chairpersons (Government of India 1995) (Annex-9).

(iii) The National Plan of Action for the Girl Child (1991-2000 AD): The Plan of Action is to ensure survival, protection and development of the girl child with the ultimate objective of building a better future for the girl child.

Some of the important schemes of the Government include the following:

(i) Balika Samridhi Yojana (BSY): This scheme has been launched as part of a long term strategy to raise the status of girl child while changing social attitude towards her. The specific objectives of the Balika Samridhi Yojana are to change family and community attitude to the girl child at birth towards her mother and to improve enrolment and retention of girl children in school. The scheme provides for financial assistance at the time of the birth of the girl child and during her school studies.

(ii) Swayamsiddha (formerly known as Indira Mahila Yojana (IMY): This scheme was launched in March 2001 recasting the earlier scheme- Indira Mahila Yojana (IMY) into an integrated programme for women's empowerment, and expanding it from the existing 238 blocks to 650 blocks by the end of the IXth

Plan. The vision of the scheme is to develop empowered women who will demand their rights from family, community and government have increased access to, and control over material social and political resources, have enhanced awareness and improved skills and be able to raise issues of common concern through mobilisation and networking. Details are given in Annex 6.

(iii) Rural Women's Development and Empowerment Project (Swa-Shakti)

The Swa-Shakti Project, earlier known as Rural Women's Development and Empowerment Project, was sanctioned in 1998 with an estimated outlay of Rs 186.21 crores. The overall objective is to strengthen the processes and create an environment for empowerment of women. The overall objective is to strengthen the processes and create an environment for empowerment of women. The Project involves setting up of Revolving Funds in the Project States for giving interest-bearing loans to beneficiary groups primarily during their formative stages. The project helps develop linkages between SHGs and lending Institutions to ensure women's continued access to credit facilities for income generation activities, women's access to resources for better quality to life, including those for reduction of drudgery and time-saving devices.

6.7.1.2 PROGRAMMES ON HEALTH AND LITERACY

The Ministries/Departments of the Government of India are implementing a variety of programmes/schemes on health, literacy and community development. These programmes are being implemented by Department of Family Welfare, Department of Education, Department of Women and Child Development, Ministry of Social Justice & Empowerment, Ministry of Rural Development etc. The details of some of the major and important schemes are as under:

(i) Reproductive and Child Health Programme (RCH): The RCH is an integrated health programme which aims at holistic approach for improving the health status of young women and children in the country. The concept of RCH is to provide to the beneficiaries need-based, client centred, demand driven, high quality and integrated health components for child survival, safe motherhood and reproductive health both for men and women. Details are given in Annex 7.

(ii) Integrated Child Development Services (ICDS): The ICDS is the world's largest and a unique community based outreach integrated programme for holistic early child care and development. The programme provides an integrated approach for converging basic services for improved childcare, early stimulation and learning, health and nutrition, water and environmental sanitation - targeting young children, expectant and nursing mothers and women's/adolescent girls' groups, supportive community structures/women's groups - through the *anganwadi* centre, the health system and in the community. They are reached through nearly 5,00,000 trained community-based *anganwadi* workers and a large number of helpers. At present 4200 blocks have been operationalised benefiting about 3.5 crore children under 6 year of age and about 50 lakhs expectant and nursing mothers and adolescent girls.

In addition to children below six years of age, ICDS also takes care of the essential needs of pregnant women and nursing mothers residing in socially backward villages and urban slums. While selecting the location for a project, preference is given to those areas which are predominantly inhabited by vulnerable and weaker sections of the society, i.e. Scheduled Castes, Scheduled Tribes and low income families found in economically backward areas, drought prone areas and areas in which development of social services requires strengthening.

(iii) Literacy Programmes

Universalisation of Elementary Education (UEE) has been accepted as a national goal. In order to achieve this goal, a number of literacy programmes are being implemented at the national level under “**Operation Blackboard**” and other literacy programmes. Some of these programmes are given in Annex 6.

6.7.1.3. SCHEMES FOR WELFARE AND DEVELOPMENT OF THE SOCIALLY BACKWARD COMMUNITIES

The Ministry of Social Justice & Empowerment is funding a large number of schemes/programmes for the empowerment of the disadvantaged and marginalised sections of the society such as scheduled castes, minorities, other backward classes, disabled, aged, drug afflicted, juvenile delinquents, street children, abandoned and destitute children. The Ministry of Tribal Affairs is funding programmes for welfare of the tribals. Some of the important schemes and programmes of this ministry are given in Annex 6.

6.7.2 Local Community Development Programmes

The Ministry of Rural Development is implementing a number of activities/programmes on community development, awareness generation especially meant for the people below the poverty line in rural area. Some of the important programmes are discussed below :

6.7.2.1 Jawahar Gram Samridhi Yojana (JGSY): The JGSY is being implemented with the objectives of creation of demand driven community village infrastructure including durable assets to increase the opportunities for sustained employment and also to generate supplementary employment for the unemployed poor in the rural areas. The wage employment is given to below poverty line families. The programme is being implemented through Village *Panchayats* which receive funds from DRDAs/Zila Parishads directly. Details are given in Annex 6.

6.7.2.2 Rural Drinking Water Supply and Sanitation: The Government of India has accorded high priority to cover all rural habitations with access to safe drinking water by 2004. Although drinking water supply in rural areas is a State subject, the Central Government supplements the efforts of the States by providing financial assistance under the Accelerated Rural Water Supply Programme (ARWP) and the Prime Minister’s Gramodaya Yojana - (Rural Drinking Water) (PMGY - RDW). In order to attain this goal, the Department of Drinking Water Supply was created in the Ministry of Rural Development in October 1999.

The Central Government has adopted a four-pronged strategy:

- (i) to cover all rural habitations, especially the non-covered and partially covered ones, with safe drinking water.
- (ii) to ensure sustainability of the systems and sources.
- (iii) to tackle water quality problems in affected habitations and preserve good quality by institutionalising water quality monitoring and surveillance through a catchment area approach.
- (iv) to carry out fresh survey to assess the extent of the problem.

The Government has also adopted the following norms:

- 40 litres per capita per day (lpcd) drinking water for human beings.

- 30 lpcd additional water for cattle in the Desert Development Programme (DDP) areas.
- One handpump or standpost for every 250 persons.
- Water source within the habitation or within 1.6 km in the plains and 100 m elevation in hilly areas.

In the last successive years due to failure of monsoon, drought-like situation has been created in many parts of the States of Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, and Rajasthan. The Department of Drinking Water Supply has taken the following specific steps to tackle the issues of Rural Drinking Water Supply in desert areas. While for general areas the norms adopted for providing potable drinking water to the rural population is at a rate of 40 lpcd, in the 227 blocks of the 36 DDP districts, provision has been made for making available 40 lpcd of drinking water for human consumption and 30 lpcd for animals.

Rural Sanitation Programme

The restructured centrally sponsored Rural Sanitation Programme (RCRSP) proposes to move away from the principle of State-wise allocation of funds primarily based on poverty criteria to a “Demand-driven” approach in a phased manner with a view to achieving at least 50% coverage of rural population by the end of the 9th Plan period.

6.7.2.3. Activities of Council for Advancement of People’s Action and Rural Technology (CAPART):

Voluntary action plays an important role in development particularly with reference to the programmes aimed at the rural poor and for improving the quality of life in rural areas. With a view to encouraging promoting and assisting voluntary action in rural development and with focus on injecting new technological outputs for the enhancement of rural property, CAPART was set up under the aegis of Ministry of Rural Development. Some of the activities being undertaken by CAPART with people’s participation and the voluntary sector are as under :

- a) People’s participation in water supply schemes or rehabilitation of degraded lands or any capacity building projects.
- b) Assistance to voluntary organizations for construction of houses with infrastructure such as roads, soakpits, other common facilities and individual sanitation units for healthy and hygienic living to the targeted population, consisting of SCs/STs/forced bonded labourers and other socially and economically weaker sections of the society through Indira Vikas Yojana.
- c) Support for programmes to tackle ecological crisis and conserve soil.
- d) Advancement of technologies which benefit people in rural areas. These include construction/housing technologies, water conservation, village industries, food processing, herbal medicines, energy, biomass utilisation, handicrafts etc.
- e) Financial assistance for creating employment and income generation among the rural poor.
- f) For improving the quality of life, safe drinking water and rural sanitation programmes are implemented through voluntary organizations.
- g) Awareness generation programmes to create awareness among the rural poor, organise them into groups and strengthen their bargaining capabilities.

6.7.3 Income Generation Schemes for Poverty* Eradication

The people living in degraded regions, drought prone and desert areas have very limited sources of income. The income from agriculture is not assured. Scarcity of water is acute to maintain cattle for dairy activities.

Power is also not assured. There are problems about transportation, availability of raw materials and reliable market for sale of finished goods. Despite efforts made for the past few decades, rural poverty in India continues to be significant. With a view to raising the economic status of the people living below poverty line in the drought prone and desert areas and eradication of poverty, there is need to implement skill building and income generation schemes in an integrated manner. A number of these are under implementation and are briefly given at Annex 6.

6.7.4. Credit Assistance for Rural and Agro-based Activities and Schemes

6.7.4.1. Micro-Credits for Rural Development: Government policy has made banks “Change agents” for rural development with specific targets to achieve, assigning about 40% total credit to priority sectors (agriculture and allied activities, small scale industries, self employed retail trade and transport business, etc.), 18% for agriculture, 40% assistance under IRDP to women and 50% to SC/ST beneficiaries, etc. The Banks provide differential interest rate ranging from 4 to 19% for rural credit (particularly agriculture and animal husbandry) aimed at the economically and socially weaker sections. The Commercial banks are often rigid, unwilling and often take away the advantages of the government’s socially oriented schemes and of low and differential interest rates. Co-operative banks are more sympathetic to rural credits and is more flexible and accessible to credit seekers. The traditional money lender is also well entrenched form of credit institution in India and his influence among the rural population is still formidable. It is estimated that they service the credit needs of almost 30-50% of the rural producers and often with interest rates, which could be as high as 16 to 30%. (MOA, 1996).

Box 6.6 GRAMEEN BANK, BANGLADESH - A SUCCESS STORY

The emergence of “Grameen (Rural) Bank’ in Bangladesh as a key factor has been successful in developing the rural economy and bringing out the positive social changes. Prof. Mohammad Yunus launched an action-research-programme in 1976 at Jobra Village to explore possibilities of credit access by rural poor-landless and women, which finally got the shape of GRAMEEN BANK. As per this, loan recipients are landless who get loans organising themselves into groups of like-minded persons with almost the same socio-economic status. A person is eligible to get loan if his/her family owns less than half an acre of cultivable land, and the value of whose family assets does not exceed the market value of one acre of land. The eligibility criteria is remarkable for it ensures targeting the poorest of poor. The group intensely watches the repayment. The cumulative repayment rate in 1995 was about 98%. The success of Grameen Bank is due to the following factors:

I. An Appropriate Banking system

- Intensive supervision and monitoring of repayment rather than enforcing tough rules and regulations.
- Continual efforts to become self-sustainable and autonomous.
- Hard work to manage the sanction of small loans and weekly repayment instalments.

II. Engagement in Social Development

- Women empowerment (93% of borrowers are women) - motivating as well as monitoring people to get married without dowry, no loan to a man with two wives, intensive and extensive workshops organised for women’ awareness.

* Poverty estimates for India and its various States are made by using a poverty line cut-off, after fixing a price for the minimum required consumption levels of food, clothing, shelter and fuel. Allocation of health and education are excluded since it is presumed that the Government provides these free of cost. A norm of 2,400 calories per day for rural and 2,100 calories per day for urban areas is used as a minimum. The methodology focuses on the purchasing power needed to meet the specific calorie intake standard with some margin for non-food consumption (Source: Planning Commission).

- Promoting children' education.

III Successful Organisational Pattern

- Decentralised flow of information.
- Staffing Network.
- Ensuring the feedback on innovative ideas enforced by Grameen Bank.

The concept of micro-financing, started by Prof. Muhammad Yunus is presently replicated in 52 countries. Many international NGOs such as the Foundation for International Community Assistance (FINCA), ACCION, Women' World Banking, Freedom From Hunger, etc., are executing projects, through their partners in developing countries. Prof. Yunus has estimated that of the 1.2 billion poor in the world, Grameen has reached 2 million, other services on similar lines covering another 1.5 million in Bangladesh. International replicates have about 2.5 million borrowers. It is estimated that this has overall helped 36 million people worldwide.

Source: Kurukshetra - A Journal on Rural Development - October 2000, p 24-27.

On March 16, 2001 the Hon'ble President of India, Sh. K.R. Narayanan presented the "Gandhi Peace Prize, 2000" to Prof. Muhammad Yunus, Managing Director, Grameen Bank, Bangladesh along with Dr.Nelson Mandela, Former President, South Africa.

Times of India- New Delhi, March 16, 2001

6.7.4.2. National Bank for Agriculture and Rural Development (NABARD): Sustained and broad-based growth of agriculture is essential for alleviating poverty, generating incomes and employment, assuring food security and sustaining a buoyant domestic market for industry and services. In order to strengthen the rural economy, credit flow to agriculture through institutional channels of commercial banks, co-operative banks and regional rural development banks is available. The National Bank for Agriculture and Rural Development (NABARD), an apex developmental institution for rural credit came into existence in 1983. Its main function is to refinance rural credit institutions such as Co-operative Banks, commercial banks for rural projects and regional rural banks to promote agriculture including animal husbandry, rural development, agricultural marketing and distribution. The Department has initiated Rural Infrastructure Development Fund (RIDF) managed by NABARD. The scope of RIDF has been widened to allow lending to *Gram Panchayats*, Self-Help Groups, NGOs and other eligible organisations for implementation of village level infrastructure projects. From this year, the Government has set up Micro-finance Development Fund with NABARD to cover Self-Help Groups with special emphasis to develop micro enterprises in rural areas. These initiatives can be very useful for helping Self-Help Groups, NGOs, *Gram Panchayats* for taking up income generating activities for poverty eradication in drought prone areas.

Wasteland development has been given top priority by NABARD. Realising its importance NABARD started implementing this programme more than a decade ago by providing refinance facilities to the financial institutions in respect of loans advanced by them to farmers/corporate bodies undertaking wasteland development activities. The different types of schemes refinanced so far by NABARD may be grouped as follows:

- a) Farm Forestry: The scheme relates to raising of trees on individual farmlands. Since good agricultural lands are not to be utilised for forestry purposes in conformity with the National Forest Policy, NABARD refinances schemes for raising of trees on wastelands.

The various schemes that may fall under this category are: firewood plantations, pulpwood plantations, horticultural crops, medicinal plantations, fodder development schemes, nursery development schemes, shifting cultivation control schemes, captive firewood plantation schemes by tea estates, bamboo plantations etc. While primarily farm forestry is meant for individual farmers, a number of wood based industries have also raised such plantations on individual wastelands through tie-up arrangements on mutual sharing basis.

- b) Agro-forestry: In this case trees are raised along with agricultural crops, horticultural crops, grasses, etc. on the same piece of wastelands/marginal lands. Raising of trees on good agricultural lands is also permitted under agro-forestry along with agricultural crops on the same piece of wasteland/marginal land.

NABARD approves farm forestry/agroforestry/watershed development schemes for wasteland development if the projects are technically feasible and financially viable and whose basic objective is to produce firewood, pulpwood, fruits, small timber etc. for the benefit of the society as a whole. Quick growing commercially viable tree species need to be selected and also a proven technology has to be employed. It recommends that trees such as Neem, *Jatropha*, Kadam, *Eucalyptus*, *Jajoba*, Teak, etc. be given due importance in the projects, in addition to species such as *Acacia*, *Casuarina*, Subabul, Sissoo, Tamarind, bamboo and grasses either as mono-culture or in mixed plantations for producing firewood, fodder, timber etc. for the rural masses of the country. NABARD fixes targets for wastelands development annually, however, the achievements have not been very promising.

6.7.4.3 Apex Finance & Development Corporations

The Ministry of Social Justice and Empowerment has set up five apex Corporations, viz., the National Scheduled Castes and Scheduled Tribes Finance & Development Corporation (NSFDC), the National Safai Karamcharis Finance & Development Corporation (NSKFDC), the National Backward Classes Finance & Development Corporation (NBCFDC), the National Minorities Development and Finance Corporation (NMDFC) and the National Handicapped Finance and Development Corporation (NHFDC) as companies (not for profit) under Section 25 of the companies Act, 1956 with the objective of providing institutional finance at a concessional rate to specific target groups belonging to various weaker sections of the society. The Ministry, through these corporations, endeavours to empower the weaker sections such as scheduled castes, scheduled tribes, safai karamcharis, other backward classes, minorities and the disabled to make them self-reliant by way of providing soft loans for various income-generating schemes.

The loan extended by these Corporations can be broadly categorised as: Term Loan, Bridge Loan, Margin Money Loan, Micro Finance, etc. The loans are generally given for agriculture and allied activities, small business, services sector, transport sector, technical trades, etc. These Corporations extend finance through State Finance and Development Corporations or through State Channelising Agencies. The Corporations have been making special efforts to reach out to the target groups through nomination of additional Channelising Agencies and dovetailing of the credit to the beneficiaries with schemes in handloom, handicraft and dairy sectors.

6.7.4.4 Microcredit Assistance to Women Through NORAD

This programme was launched in 1982-83 with assistance from Norwegian Agency for Development Coop-

eration (NORAD). Under this programme, financial assistance is given to Women's Development Corporations, Public Sector Corporations, autonomous bodies and voluntary organisations to train poor women, mostly in non-traditional trades and to ensure their employment in these areas. Some of the trades are computer programming, electronics watch assembling, radio and television repairs, garment making, secretarial practices, community health work, embroidery, weaving, etc. Financial assistance is given to the grantee organisation for hiring of training-cum- production sheds, training costs, machinery and equipment, stipend to the trainees and remuneration for the trainers. The upper ceiling for assistance is Rs. 8000/- per beneficiary.

6.7.5 Capacity Building and Strengthening the Roles of Various Stakeholders. Identifying Programmes and Schemes that can be taken up for Strengthening LADP in the Degraded Regions of the Country.

The working conditions and other facilities in degraded regions are different from normal areas. The facilities in the form of infrastructure, transport, communications, literacy, community participation, health etc. are poor to negligible. But one thing is very clear and important that the people have the will and mental strength of survival under most difficult conditions. Therefore, if they are given a small push, they will come up with excellent results. In this regard, the capacity building and strengthening of roles of various stakeholders is the most important component in case the approach of Local Area Development Programmes is to be made successful in the desert/drought prone areas. At present different agencies are involved in the implementation of various programmes. Most of these programmes have the government officials, PRI members, field and village level functionaries self help groups, NGOs, volunteers, users and the community at large. Some of the training programmes/schemes being implemented by various Ministries/Departments under various programmes are discussed in the following sections.

6.7.5.1 Capacity building under Watershed Programmes for Wastelands Development

(i) Community Organisation: Activities will include organising self-help and user groups, conducting Participatory Rural Appraisal (PRA) exercises, awareness camps, exposure visits and programmes on literacy, family welfare, social services, income-generating activities, etc. giving small contributions to SHGs or other village institutions like *mahila mandals*/youth clubs/*anganwadis* which are considered important for getting people's participation.

- a) Training :** This component includes training of watershed users, Watershed Committee Secretaries and the Volunteers. For the watershed users, training is given in the technical aspects of *in-situ* soil and moisture conservation techniques, operation and maintenance of community/individual civil works, agriculture/horticulture/social forestry/plantation technique, raising community/individual nurseries, dairy and livestock management, fodder and pasture management, pisciculture and other land uses, etc. group activity and conduct of meetings, maintenance of accounts and procedures for execution of civil works. For the paid staff, training includes in addition to the items mentioned above, record-keeping, conduct of meetings, administrative and accounting procedures of *Panchayati Raj* Institutions, DRDA and State Departments.
- b)** Training of farmers to take up new and improved methods of land use under the scheme of Technology Development, Extension & Training for Wastelands Development in Non-Forest Areas.

The Ministry of Rural Development also organises a large number of training programmes through a network of training institutes at the National, State and District/block levels. These include NIRD at the national level, SIRDs at the States level and Extension Training Centres which impart training to village/block level development functionaries. The Extension Training Centres are being strengthened to meet the training requirements of *Panchayati Raj*/Rural Development functionaries. Each scheme/programme of the Ministry of Rural Development has a component of training for its stakeholders. Special training components for women empowerment are also available especially under EAS, SGSY, JGSY, CAPART, CRSP and for members of PRIs.

6.7.5.2 Integrated Child Development Services (ICDS) Training Programme: The Department of Women and Child Development has launched a very extensive and ambitious ICDS Training Programme. The programme envisages training of all ICDS functionaries, joint training with para-medical staff especially AMMs, training/orientation of all those who are directly or indirectly concerned with the implementation of ICDS Programme. A component of area specific training has also been included for ICDS functionaries and others concerned may also be trained to tackle area specific problems through the instrument of *Anganwadi* Centres at the village level. ICDS training is being imparted through NIPCCD, New Delhi and its three regional centres, *Anganwadi* Training Centres and Middle Level Training Centres, etc. set up in various parts of the country.

6.7.5.3 Support to Training and Employment Programme for Women (STEP): To provide training for skill upgradation and strengthen the employment of women in the traditional sectors of Agriculture, Small Animal Husbandry, Dairying, Fisheries, Handlooms, Handicrafts, Khadi and Village Industries, Sericulture, Social Forestry and Wasteland Development. Target Group/beneficiaries includes poor and assetless women like wage labourers, unpaid family workers female headed households, migrant labour, tribals and other dispossessed groups of women.

6.7.5.4 Setting up of Employment and Income Generating Training-cum-Employment-cum-Production Units for Women - Women's Economic Programme: To train women belonging to weaker sections of society and provide them employment on sustained basis. Target Group/beneficiaries includes Rural Poor women, women from weaker sections (SC & ST), war widows, widows of employees in the above mentioned enterprises and poor women of urban slum areas. Financial assistance is given for training the target groups.

The Ministry of Social Justice & Empowerment is also implementing a number of training and capacity building programmes for education and empowerment of the beneficiaries belonging to backward classes and those living below poverty line. Some of these training activities relate to income generation. This Ministry also has its own training institutes especially for training of SCs and STs.

The Ministry of Agriculture has a very extensive network for agricultural extension and training. The contribution of ICAR Institutes, Agricultural Universities and Extension Directorate of the Agriculture Ministry is very important. Some of the important training programmes are mentioned below:

- i. Extension Training Support
- ii. Training in Extension methodology & Communication techniques

- iii. Training in Subject Matter Areas
- iv. Training of women in Agriculture

6.7.6 Meeting Energy Needs of the Rural Sector

Measures for Meeting Domestic Energy Needs, Development and Conservation

Fuelwood use certainly contributes to the degradation of land resources. This form of degradation, however, is far from universal; indeed in most rural areas, fuelwood gathering for local use has only marginal, if any, impact on land resource quality. It is a problem precisely where the rural economy and environment is most vulnerable: in localities where the resource base is already under threat and where the community has less resources.

As early as 1974, the government recognised that renewable energy resources can provide the basis for sustainable energy development on account of their environment-friendly features and set up the Fuel Policy Committee (FPC) to analyse the country's energy situation. The committee noted in its report, submitted in 1974, that nearly one-half of the total energy consumed in the country comes from non-commercial sources such as firewood (including charcoal), cowdung and vegetable waste. This has led to a large-scale denudation and destruction of forests (Planning Commission, 1974). The report predicted a serious firewood shortage by 1985 unless a massive programme of plantation of fast growing species was undertaken.

The Government of India set up the Department of Non-Conventional Energy Sources (DNES) in 1982 to promote the development and use of non-conventional energy sources in the country. The Department was upgraded to a full fledged Ministry in 1985. The 1991 census results (Census of India 1991) also confirmed that, of the 151 million households in India in 1991 (consisting of 39.5 million in urban areas and 111.5 million in rural areas), 92 percent in rural and 39 percent in urban areas were dependent on bio-fuels. The census also shows that states with large tracts of hills and mountains like the north-eastern states are still heavily dependent on firewood.

The annual potential of non-conventional energy generation in the country as estimated by the Ministry of Non-Conventional Energy Sources (MNES) is given in Table 6.9 below:

Table 6.9: Annual Potential of Non-conventional Energy Generation in the Country

Biomass	17,000 MW
Solar Energy	20 MW/sq.km
Wind	20,000 MW
Small Hydel Power	15,0000 MW
Ocean Energy	79,000 MW

Source: TERI quoting MNES in GEF Workshop organised by World Bank in New Delhi on 19.2.2001

Steps have already been taken to augment renewable energy sources by initiating programmes for tapping solar energy, by harnessing wind power, by undertaking plantation programmes with people's participation and by encouraging farmers to plant trees on their fields. During the Eighth Plan (1992-97) the Indian Renewable Energy Development Agency (IREDA) with World Bank assistance developed small hydro and

windfarms and photovoltaic market development was undertaken with assistance received from Global Environment Facility (GEF).

In addition, the National Project on Biogas Development, which seeks to promote family type biogas plants, was started in 1981-82 with the objective of reducing the pressure on forests and to reduce drudgery of rural women. It is estimated that up to March 1999, 2.9 million plants had become operative thereby achieving 24 percent of the existing potential. It was observed that the use of biogas helped in reducing the consumption of firewood and twigs by about 1,200 kg per household per year. Besides, a biogas plant produced digested slurry containing nitrogen equivalent to 299 kg of urea every year. The use of traditional *Chulhas* (Stoves) is not only fuel-inefficient but also is a major source of indoor air pollution, affecting a large percentage of rural women in the country. The National Programme of Improved *Chullhas* is also being implemented since 1985-86 to improve energy conservation. The thermal efficiency of these *chullhas* is about 20-30 percent as compared to 6-10 percent in the traditional *chullhas*. So far, over 30.9 million improved *chullhas* have been provided to the rural and semi-urban households; this is against an estimated potential of 120 million households (MNES, 1998 and 2000).

Programmes for Conservation of Land Resources and Eco-restoration of Degraded Lands

6.7.7 Land Development and Conservation Programmes

6.7.7.1 National Watershed Development Project for Rain-fed Areas (NWDPR)

The Ministry of Agriculture in 1985-86 initiated the National Watershed Development Project for Rainfed Agriculture. The programme was redesigned by the MOA in the early nineties as NWDPR, for treatment of arable lands and consisted mostly of crop production components. The Programme was re-designed in 1992-93 with focus on development of micro-watersheds as models of comprehensive and integrated development in different agro-climatic regions of the country. New programme includes measures such as conservation of rainwater in micro-watersheds, promotion of *in situ* moisture conservation on arable lands and development of multi-tier vegetation consisting of grasses, shrubs and trees on non-arable land and treatment of drainage basins.

Box. 6.7: National Watershed Development Project for Rainfed Areas (NWDPR) - Salient Features

- Promotion of low-cost and eco-friendly technology.
- Integrated watershed management approach.
- Farming systems development.
- People's participation through suitable institutional arrangements.
- Management of common property resources and cost-benefit sharing
- Long-term sustainability.
- Major components of the project includes:
 - establishment of nurseries.
 - training and human resources development.
 - research support.
 - innovative activities.
 - transfer of technology.
 - capacity building.
 - community organisation.

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| <ul style="list-style-type: none"> · <u>Field activities include:</u> <ul style="list-style-type: none"> - treatment of arable lands. - treatment of non-arable lands and drainage lines. - production systems - involving crop demonstration. - rainfed dryland horticulture. - agroforestry. - overseeding of grass. - fodder cultivation. - planting of trees and shrubs. - livestock development programme for fodder, primary health care and preventive medication. - household production systems - for marginal farmers and the landless. |
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The Project has now been restructured based on the “Common Approach for Watershed Development” (MOA, 2000). At present this is the largest project in terms of scope and extent. Impact evaluation studies both on the ground and through remote sensing techniques have shown that watershed-based interventions have led to increase in ground water recharge, increase in number of wells and water bodies, enhancement of cropping intensity, changes in cropping pattern, higher crop yields and reduction in soil loss (MOA, 2000).

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| <p>Box. 6.8. NWDPR</p> <ul style="list-style-type: none"> · Optimising and stabilising production systems particularly crop production through rainwater conservation on land having agricultural potential - agroforestry, dryland horticulture and mixed farming. · Up to the end of Eighth Plan an area of 4.23 mha was developed covering 2,554 watersheds in 25 States and two Union Territories at an expenditure of Rs. 9,669.2 million. · Financing pattern is 100% central assistance comprising 75% grant and 25% loan to the States. · Covering 25 States and 2 Union Territories in 15 agro-climatic zones covering an area of 4.23 mha with an expenditure of Rs 966.93 crores during the 8th Plan and Rs. 10200 million to cover 22.5 lakh area. |
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6.7.7.2 Soil Conservation in the Catchment of River Valley Projects (RVP)

RVP was launched in 1962-63. The scheme is being implemented by the Ministry of Agriculture in 45 catchments spread over 20 States. The total catchment area of 45 catchments is 96.1 mha of which 25.62 mha area falls under high and very high priority. Upto the end of the 8th Plan, about 3.9 mha have been treated at a cost of Rs 820 crores. During the Ninth Plan, Rs. 600 crores have been provided to cover 8.7 lakh ha. The GOI scheme is 100% with 50% as grant assistance and 50% as loan to States.

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| <p>Box. 6.9. Salient Features of River Valley Projects (RVPs) and Flood Prone Rivers (FPRs)</p> <ul style="list-style-type: none"> · Implemented in 45 catchments in 20 States. · To reduce high rate of siltation into reservoirs. · To minimise flood hazards in flood prone rivers of Indo-Gangetic basin by increasing capacity of rainwater holding in catchment areas. · Development of degraded land by appropriate soil & water conservation measures. |
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6.7.7.3 Integration of Land Development Programmes into All India Coordinated Research Project for Dryland Agriculture (AICRPDA)

In 1960, the State and Utilisation Committee appointed by the Government of Rajasthan made its recommendations on the development of desert and semi-desert areas of the State. In 1966, the Desert Develop-

ment Board with nominees of the States of Rajasthan, Gujarat and Haryana and representatives of other Central Ministries was constituted with Secretary, Ministry of Agriculture (MOA) as its Chairman. However, the emphasis in the programme of the Board was mainly restricted to agriculture development only. In 1971, the Board was reconstituted with the Minister of State in MOA as its Chairman and Secretary of Agriculture as its Vice-Chairman, thus raising the status of the Board (NCA, 1974). On the basis of the recommendation of the Board, an integrated programme of pilot projects for desert development was proposed in the Fourth Plan (1969-1974). During the Fourth Plan the All India Coordinated Research Project for Dryland Agriculture (AICRPDA) with headquarters in Hyderabad was launched with emphasis on soil and rainwater management, and identification of drought tolerant crops/varieties, cropping system. Two projects were started at the same time - (i) Integrated Dryland Development was also launched near the vicinity of those 24 stations with the purpose of testing the R&D in those stations AICRPDA subsequently became CRIDA. In 1983, All India Coordinated Research project on Agrometeorology (AICRPAM) was established to provide the required support to strategic and location-specific research in dryland farming. The Project Directorate of AICRPDA was upgraded as Central Research Institute for Dryland Agriculture (CRIDA) in 1985 giving a fillip to dryland agricultural research countrywide. AICRPDA centres continued to address location-specific problems.

6.7.7.4 CAPART aided watershed projects

Council for Advancement of People's Action and Rural Technology (CAPART) has the mandate to promote voluntary action and to propagate appropriate rural technologies among the rural people. By February 2000, the Council had supported 211 community-based project-implementing agencies (PIAs) for watershed management programmes in the country (MORD, 2000).

6.7.8 Programmes for Natural Resource Conservation

6.7.8.1 Afforestation Programmes

The Ministry of Environment and Forests in consultation with the State Governments fix targets for afforestation/tree planting activities annually. These afforestation activities are taken up under various schemes/programmes of different Central Ministries/Departments and of State Governments. During the last 50 years since independence, around 27 mha of land has been brought under tree cover in the various plan periods at a cost of about Rs.70,000 million (MOEF, 1999). These include major schemes/projects related to forestry that help combat desertification and drought. External assistance in forestry sector started in 1980 with the implementation of World Bank aided Social Forestry projects.

Other associated programmes of the GOI for conservation of biodiversity and other natural resources (wetlands, biosphere reserves, etc.) are described briefly in Annex 6.

6.7.9 Measures for Revegetation and Eco-restoration of Degraded Lands and Wastelands

Seedling distribution and tree planting are undertaken through a large number of projects/programmes, big and small, under the control of State Forest Departments and some other agencies;

(i) MOEF

- Integrated afforestation and eco-development projects.
- Association of scheduled tribes and rural poor in regeneration of degraded forests on usufruct sharing basis.
- Area oriented fuelwood and fodder production scheme.

- Plantation of non-wood forest species including medicinal plants.
 - Grants-in-aid to voluntary agencies.
- (ii) Other Ministries
- Integrated wasteland development programme.
 - Desert development programme (DDP).
 - Drought prone areas programme (DPAP).
 - Soil conservation, watershed management and other integrated programmes of the Department of Agriculture & Cooperation, Ministry of Agriculture.

The major schemes amongst these are briefly described below:

6.7.9.1 Integrated Afforestation and Eco-development Project Scheme (IAEPS)

The scheme is intended to promote afforestation and development of degraded forests by adopting an integrated approach to the development of land and other related natural resources on watershed basis through the micro-planning process. The scheme is 100% Centrally Sponsored. The revised Ninth Plan allocation for the scheme is Rs. 273.87 crores (proposed physical target is 1.88 lakh ha). 104 projects have been sanctioned so far to the States in the Ninth Plan with a total outlay of Rs. 211.35 crores.

6.7.9.2 Integrated Wastelands Development Programme (IWDP)

The IWDP has been under implementation under the Ministry of Rural Development since 1989-90. From April 1995 IWDP is being implemented on watershed basis under the common guidelines for the watershed development (MORD, 1994.). During Eighth Plan (1992-93 to 1996-97) a total of 284,000 ha have been treated at an expenditure of Rs. 2161.6 million (MORD, 1998).

Box. 6.10 Integrated Wastelands Development Project (IWDP)

- Pilot projects in States aimed at integrated land management and wastelands development based on village/micro watershed plans.
- People's participation in wastelands development programme at all stages.
- Major activities include:
 - Soil and moisture conservation measures such as terracing, bunding, trenching, vegetative barriers, etc.
 - Planting and sowing of multi-purpose trees, shrubs, grasses, legumes, and pasture land development.
 - Encouraging natural vegetation.
 - Promotion of agroforestry and horticulture.
 - Wood substitution, and fuel-wood measures.
 - Measures needed to disseminate technology.
 - Training, extension and creation of greater degree of awareness among the participants.

6.7.9.3 Eco-Task Forces: Four Eco-Task Forces (ETF) of ex-servicemen are being funded by NAEB. These ETFs comprise of ex-servicemen and are commanded by serving JCOs and Commissioned Officers. Forest Departments of the State Governments, in which the ETFs are located, provide technical support to the ETFs. The activities undertaken include afforestation, pasture development, soil and water conservation

and other restorative works. The total allocation for the Ninth Five Year Plan for the scheme is Rs. 30 crores. Expenditure during 1998-99 was Rs. 5.29 crores. The achievements of ETFs upto 1998-99, and their locations are as follows (Table 6.10):

Table 6.10: Eco-Task Force

Name of the Task Force	Area of operation	Achievements till 1998-99			Funds released in 1999-2000 (Rs. in crores)
		Mined area reclaimed (Nos.)	Seedlings Planted (in lakhs)	Area to be covered (in hectares)	
127 Infantry Battalion	Kiarkuli (U.P.)	25	51.48	8,222	7.42*
128 Infantry Battalion	Bikaner (Raj.)	-	115.50	8,343	
129 Infantry Battalion	Samba (J&K)	-	13.54	1,538	
130 Infantry Battalion	Pithoragarh (U.P.)	-	26.35	2,100	

*: As on 03.03.2000 (Source: MOEF)

Box. 6.11 Uttar Pradesh - Green Brigade

From 9,000 feet below in Mudrai Village it is difficult to make out the ant like movements high up in the Garhwal mountains. Climb uphill and one gets a closer view of soldiers in 'combat gear'. "We are fighting to bring green revolution to these barren hills", says Naik Laxman Singh. "and we will surely win the war". He is part of the eco-task force, the only army unit in the world, entrusted with eco-conservation. The force was raised in 1982 in Landsdowne, the headquarters of Garhwal Rifles, in Uttar Pradesh. The Task Force has nurtured and guarded 50 lakh trees on 6,500 hectares, and won the Indira Gandhi Paryavaran Puraskar in 1992 and the Doon Ratna Award in 1998.

The Task Force's first assignment was in Mohand area in Shahjahanpur ranges in Dehradun. Encouraged by the success, it was sent to Pithoragarh in Kumaon Hills, Samba in Jammu and Kashmir and Jaisalmer in Rajasthan. The Force took up afforestation programmes in Kairakuli micro catchment and development area in the Mussorie hills. "When the project was undertaken, there were a few green patches. Reckless mining had taken its toll", says Naik Mahendra Singh, proudly pointing to the lush green hill slopes. The Eco-Task Force planted saplings on 3,400 hectares besides reclaiming 25 mining areas. The scars of mining are slowly vanishing.

Source: The Week, June 11, 2000 page.26.

6.7.9.4 Scheme for Reclamation of Alkali Soils

The scheme is being implemented by the Min. of Agriculture in seven States on a 50:50 sharing basis. During the 7th and 8th Plan a total of 4.84 lakh area was covered under the scheme for an expenditure of Rs. 62.29 crores. During the 9th Plan (until 1999) Rs. 13.75 crores have been spent for reclaiming 1.02 lakh ha.

Box. 6.12 Scheme for Reclamation of Alkali Soils

- To reclaim alkali lands for increasing crop production.
- Improving land productivity.
- Raise horticulture.
- Increase production of fuelwood and fodder.
- Generate employment opportunities in rural areas.

In addition, the following schemes are also implemented by the MOEF, MORD and the MOA:

- **Swarna Jayanti Kunj under IAEPs**
- **Area Oriented Fuelwood and Fodder Projects Scheme (AOFFPS)**
- **Association of Schedule Tribes and Rural Poor in Regeneration of Degraded Forest on Usufruct Sharing Basis Scheme**
- **Conservation and Development of Non-Timber Forest Produce (including medicinal plants) Scheme (NTFP)**
- **Tree and Pasture Seed Development Scheme**
- **Plantations carried out under the Biosphere Reserve Programme**

These are briefly described in Annex 6.

6.7.10 Programmes Specially for Desert and Drought Prone Areas

6.7.10.1 Desert Development Programme (DDP)

Recognising the fact that rainfed farming is invariably associated with high risk, the Government of India (GOI) initiated research in dry farming way back in 1923 at Manjari near Pune. This was followed by establishing five more centres viz., Sholapur, Bijapur, Hagari, (near Bellary), Raichur and Rohtak. The first significant step towards development of deserts was taken in 1951-52 when GOI appointed a committee to advise on development of the *Rajasthan* desert. A Desert Afforestation Station for the study of problems of the desert was set up in Jodhpur. Subsequently the scope of works at the Station was enlarged by inclusion of soil conservation programmes and it was named in 1957 as the Desert Afforestation and Soil Conservation Station (DA&SCS). The Station was required to conduct basic and applied research in forestry, crop husbandry and grassland development to control wind erosion and aggravation of desert conditions. In 1959, under the major Arid Zone Project of UNESCO, DA&SCS was reorganised as Central Arid Zone Research Institute. In 1964, the GOI set up a working group, which examined the problems of desert development, and recommended a number of pilot projects for improvement of selected areas, which could provide the basis of an integrated programme of desert development. In 1977-78, a Desert Development Programme (DDP) was started in 20 districts (Kaul, RN, 2001)

The Desert Development Programme (DDP) is now under implementation in 227 Blocks of 40 Districts in 7 States. Since inception of the programme up to 1994-95, a total of 552,669 ha have been covered under different components of the programme (MORD, 1998 and MOF, 2000). Like DPAP, since 1995-96, this programme is being implemented on a watershed basis only. From 1995-96 to 2000-2001 a total of 5353 projects were implemented at an expenditure of Rs.536.16 crores. However, in hot sandy arid areas where it is not possible to delineate a watershed, these programmes are taken up on the basis of cluster of villages. Sectoral activities include sand dune stabilisation, shelterbelt creation and afforestation.

To ensure people's participation in planning and implementation in both the programmes viz., DPAP and DDP, a provision of creation of 'Watershed Associations' comprising adult population of the watershed has been made. The Watershed Associations elect their Watershed Committees, which are responsible for planning and implementing the watershed development projects.

6.7.10.2 Drought Prone Areas Programme (DPAP)

Drought has been a recurring feature of Indian agriculture. While practically all areas have, sometime or the

other, suffered crop losses and distress on account of drought, some clearly identifiable areas have been subject to frequent droughts. The subsistence economy in these areas is unable to absorb a particularly severe drought and the distress assumes the characteristics of a famine before long. Mitigation of distress caused by drought has for long exercised the Governments, but systematic efforts launching long-term countermeasures were not very much in evidence till planned economic development became State policy. Dry Farming Projects, initiated during the Second Plan (1956-1961), were substantially expanded during the Fourth Plan (1969-1974). The Fourth Plan suggested that much of the amount the Government of India spent on relief in famine-affected areas could be "so deployed in the areas chronically affected by drought as to generate considerable employment in rural sector largely related to a pre-planned programme of Rural Works". This thinking led, in 1970-71, to the formulation of Rural Works Programme with the objective of creating assets designed to mitigate severity of drought wherever it occurred and provide employment in the drought-affected areas. The Programme, it was intended, should spell out a long-term strategy in the context of the conditions, problems and potential of the district. In all, 54 districts together with parts of 18 contiguous districts were identified as drought prone for purposes of the Programme. The Fourth Plan Mid-term Appraisal redesignated the Programme as Drought Prone Areas Programme (DPAP). The Appraisal, incidentally, noted that Dry Farming Projects had made little progress.

However, a major turning point in the objective of the Programmes came through the recommendations of the Task Force headed by Dr. B. S. Minhas, Member, Planning Commission, which concluded that DPAP as conceived and implemented was not likely to contribute to mitigation of drought and recommended the integrated development of drought affected areas. Thus, during the Fifth Five-Year Plan (1974-1979), restoration of ecological balance through an integrated development on watershed basis with a view to insulating drought prone areas from the effect of recurring drought, became the goal. The Task Force on Drought Prone Area Programme (DPAP) and desert Development Programme (DDP) headed by Dr. M.S. Swaminathan, Member (Agriculture) Planning Commission reiterated and sharpened the emphasis on ecologically sustainable development as the objective of these programmes (Government of India 1982). Some refinements were also made through the exclusion of infrastructure-oriented works from the purview of the Programmes. There was greater conceptual clarity in the Seventh Five-Year Plan (1985-1990) as far as objectives of the Programmes were concerned. The Mid-term Appraisal of the Seventh Plan in 1988 which was influenced by the decisions taken by the Central Sanctioning Committee in 1987, clearly spelt out drought proofing and control of desertification as the main objectives of the DPAP and DDP (Kaul, RN, 2001).

RWP was re-designated as Drought Prone Areas Programme (DPAP) in 1973-74 and focused on problems of the drought prone areas only. At present the DPAP is under implementation in 961 Blocks of 180 Districts in 16 States. The total area covered under different components of the Programme since its inception to 1994-95 is about 5.7 mha.

6.7.10.3 Indira Gandhi Canal Project (IGNP)

Development of water projects in drought-affected/prone areas has helped mitigate the effects of drought. The IGNP is the best example of drought proofing of the dessert area of Rajasthan. The Project serves 19.63 hectares of culturable command area and provides drinking water facility for about 1.5 crore human population and for a large number of livestock. The Sardar Sarovar project in Gujarat will provide irrigation facilities to 17.93 lakh hectares of land (75% of which is drought prone) and to provide drinking water to 13 urban

centres and 8215 villages (45% of the total villages in Gujarat). Also, the Sardar Sarovar Project, through its Narmada Canal will provide irrigation facilities to 75,000 hectares of drought prone area in Rajasthan.

Table 6.11: Summary of Major Programmes under Central/Centrally Sponsored Sectors under Implementation by the Ministries of Environment & Forests, Rural Development & Agriculture

Ministry of Environment and Forests

Integrated Afforestation and Eco-Development Scheme (IAEPS)	To promote afforestation and Projects development of degraded forests by adopting an integrated approach to the development of land and other related natural resources on watershed basis, through the micro-planning process.
Area Oriented Fuelwood and Fodder Projects Scheme (AOFFPS)	To augment the production of fuelwood and fodder in 242 identified fuelwood districts in the country.
Conservation and Development of Non-Timber Forest Produce (NTFP) including medicinal plants	Special focus on tribal population for whom NTFP is the main source of livelihood.
Grants-in Aid scheme	Promoting peoples' participation- funds provided to NGOs and Voluntary Agencies (VA) for afforestation and tree planting activities.
Eco-Task Forces	Afforestation, pasture development, soil and water conservation and other restorative work carried out by 4 eco-task forces in selected locations. These forces comprise ex-servicemen and serving JCOs and officers.
Association of Scheduled Tribes and rural Poor in Regeneration of Degraded Forest on Usufruct Sharing Basis	For rehabilitation of degraded forests in tribal dominant areas also aims at providing wage employment and usufructs to the tribal people.

Ministry of Rural Development

Implementation of programmes for rural development including wastelands development.

Desert Development Programme (DDP)	Restore degraded areas due to soil erosion, water and moisture stress with low productivity and inadequate vegetative cover.
Drought Prone Area Programme (DPAP)	To restore ecosystems of desert areas (227 blocks of 36 districts in 7 States) affected by extreme climatic conditions (temperature, poor rainfall, low humidity and high wind velocity) combined with recurrent drought. Implemented on a watershed basis with the involvement of the <i>Panchayati Raj</i> Institutions.
Jawahar Gram Samridhi Yojana (JGSY) (formerly Jawahar Rozgar Yojana)	Executed by the <i>Panchayati Raj</i> Institutions as per the felt needs of the poor. There is no separate earmarking of funds for social forestry.
Employment Assurance Scheme (EAS)	Demand drive, with no fixed earmarking of funds for any district or block. 50% of EAS funds are utilised for watershed development only in DPAP and DDP blocks. No earmarking for forestry work.
Investment Promotional Scheme (IPS)	To facilitate/attract/channelise/mobile resources from financial institutions/banks, corporate bodies including user industries and other entrepreneurs for development of wastelands belonging to individual farmers, community/ <i>panchayat</i> , institutions and government agencies.
Support to NGOs/VAs (Grants-in-Aid)	For registered VAs to take up small programmes like plantation, soil and moisture conservation, etc.

Ministry of Agriculture

National Watershed Development Rainfed Areas	Project Aims at conservation of rainwater for holistic and for integrated development of potential watersheds and promotion of farming system approach, management of common property resources, augmenting family income and nutritional levels through household production systems.
Integrated Watershed Development Project (Hills) Integrated Watershed Development (Plains)	Designed to address the integrated development of hilly areas especially of the ecologically degraded Shivalik, Karewas ranges in Haryana, HP, J&K and Punjab. For minimising ecological degradation by Project promoting sustainable and replicable rainwater conservation measures and diversified production system.
Soil Conservation in the Catchments of River Valley Projects (RVPs)	Aims at enhancing the productivity of degraded lands, improvement of land capability, prevention of soil erosion from the catchments/watersheds and ultimately increasing the lives of reservoirs, in priority watersheds.
Soil Conservation in the Catchments of Flood Prone Rivers (FPRs)	Aims at reducing peak rate of runoff by increasing in-situ conservation of water and groundwater recharge by increasing the time of concentration resulting in reduction of flood hazards.
Reclamation of Alkali soils	Aims at improving physical conditions and productivity status of alkali soils for restoring optimum crop production.

C Monitoring Mechanism for Evaluation of Implementation of Programmes

Planning Commission

There are regular annual plan formulation, mid- year and mid-term evaluations of all programmes and schemes of the Government by the individual ministries, and the Planning Commission. Progress made on projects and programmes approved by the Cabinet are also regularly monitored. The ministries, in turn, set up Task Forces, Review, Implementation and Monitoring Committees for evaluation of progress of specific activities and expenditures.

Reports on the ‘State of the Environment’

The Ministry of Environment and Forests regularly brings out a “State of Environment” Report, which encompasses environmental status, preventive and mitigate action plans for air and water environment, solid wastes and hazardous substances management, legislative measures, other initiatives viz., carrying capacity based planning for sustainable development and cleaner production-technology policy and changes in management (SOE, 1999).

The Policies, Strategies/ Plans, Programmes and the Major Implementation Ministries and Departments for combating desertification are summarised in Table 6.12.

Table 6.12: Summary of Policies, Strategies/ Plans, Programmes and the Major Implementation Ministries and Departments Involved in Combating Desertification in the Country

Major Activities	Policy	Regulation	Strategy/Plan	Programmes	Ministry/Department
1. Conservation of Natural Resources					
Land Conservation	National Land Use Policy Outlines, 1986 , National Agr. Policy, 2000 National Forest Policy, 1988	<i>Panchayati Raj</i> Act, 1992, Forest(Cons.) Act, 1980, Env. (Prot.) Act, 1986	National Conservation Strategy (NCS), 1992, Agenda 21	RVP/FPR, Afforestation Programmes, JFM, AOFFPS, NTFP, Tree & Pasture Seed Dev. Scheme, Social forestry schemes.	MORD, MOEF, MOA
Assessments of Land use & Degraded Lands	-do-			Various schemes for survey & Assessments	MOA, MOEF/FSI, MORD, DOS
Ecorestoration of Degraded Lands	-do-	-do-	-do-	IWDP, IAEPS, Eco-Task Forces, community-based schemes, Reclamation of alkali soils	MORD, MOEF, MOA
Soil & Water Conservation	National Land Use Policy Outline, 1986			Programmes on the watershed basis, ICAR programmes	MOEF, MOA, MORD
Conservation of Forests	National Forest Policy, 1988	F(C) Act, 1980,	National Conservation Strategy, 1992, Agenda 21	Plan schemes, JFM, social forestry schemes, grants-in aid schemes	MOEF
Protection of Wildlife		National Wildlife Protection Act, 1972	-do-	Protected Areas Network	MOEF
Protection of Biodiversity		Biodiversity Bill, 2001	NCS, 1992, National & Macro-level Strategy & Action Plan for Biodiversity, 2000	Biosphere reserves, Conservation of wetlands, mangroves, hotspots of biodiversity.	MOEF
Water Resource Management	National Water Policy, 1987				MOWR, MOEF
Prevention & Control of Pollution	Policy on Abatement of Pollution, 1992	Water Act, 1974, E(P) Act, 1986	NCS, 1992		MOEF (CPCB)
Environmental Impact of Development Projects	Guidelines for various types of development projects —energy, infrastructure & transportation	Environment (Prot.) Act, 1986, Forest (Conservation) Act, 1980	NCS, 1992	On a case to case basis using the guidelines.	MOEF

2. Local Area Development Programme			
Decentralisation of powers to villages/local bodies	Constitutional Amendment, 1992/93	Drinking Water, EAS, JGSY, MDP	MORD MHRD
Community-based programmes	National Population Policy, 2000,	Income generation schemes, Poverty alleviation schemes, reproductive health, and gender empowerment schemes, human resource development schemes & projects.	MH MSW&E
Social sector programmes	National Population Policy, 2000,		
3. Special Programmes for Desert/Drought Prone Areas			
Combating and mitigating the effects of drought	National Agriculture Policy, National Water Policy, National Forest Policy, Livestock Management Perspective, 1996	Desert Development Programme (DDP), Drought Prone Areas Programme (DPAP), IGNP, etc.	MORD, DAH, MOA, MOEF, MOWR
4. Other Areas			
Livestock Management	Livestock Management Perspective, 1996	Operation Flood, Plan Programmes	MOA, MOEF, MORD
Meeting Rural Energy Needs			MNES, MORD
Climatological Activities			MOS&T (IMD, NMRWFC)

Note:

MOEF	: Ministry of Environment and Forests	MNES	: Ministry of Non-Conventional Energy Sources
MOA	: Ministry of Agriculture	MHRD	: Ministry of Human Resource Development
MORD	: Ministry of Rural Development	MH	: Ministry of Health
MOWR	: Ministry of Water Resources	MSW&E	: Ministry of Social Welfare and Empowerment
DOS	: Department of Space	CPCB	: Central Pollution Control Board
DST	: Department of Science & Technology	NRCD	: National River Conservation Directorate
IMD	: India Meteorological Department		
NMRWFC	: National Medium Range Weather Forecasting Centre		

D. TECHNOLOGIES FOR COMBATING DESERTIFICATION

6.8 Technologies for Combating Desertification

Technology packages for dryland areas have been developed by different research institutions of the Indian Council of Agricultural Research (ICAR) and the Indian Council of Forestry Research and Education (ICFRE) for combating desertification and for mitigating the effects of drought. In addition, the traditional practices, which are still relevant, need to be revived, improved and incorporated in the programme. A few of the technology packages and traditional practices are briefly discussed below.

Technology packages

A number of technologies to combat the process of land degradation have been evolved by ICAR Research Centres and State Agricultural Universities which constitute the National Agricultural Research System (NARS). In addition, the traditional technologies are also in use.

Technology packages can be broadly categorised as follows:

- (i) Technologies for conservation of soil, water and vegetation.**
- (ii) Technologies specifically to control land degradation in different bio-climatic regions:**
 - Arid
 - Semi-arid and Dry Sub-humid
- (iii) Technologies for management and reclamation of degraded lands:**
 - Mine spoils
 - Alkaline/Saline soils,
 - Water logging,
 - Industrial effluents.
- (iv) Traditional technologies for combating desertification.**
- (v) Technologies for mitigating the effects of drought.**

Each of these are briefly described below:

6.8.1 Technologies for Conservation of Soil, Water and Vegetation¹

6.8.1.1 Integrated Soil Fertility Management

Soils in the Semi Arid Tropics (SAT) are poor in fertility. Though the present materials largely influence the inherent fertility of the soils, climate and crop management have significant role in building up and maintenance of soil fertility. Soil Organic Matter (SOM) status regulates the available nutrient status of the soil not only as source but also by buffering the soil reaction (Katyal and Reddy, 1997). Nearly 95% of nitrogen and sulphur are contained in soil organic matter. Bulk of the zinc and copper are also in organic form. Therefore, decline in soil organic matter levels due to soil erosion by runoff or poor vegetal cover also multiplies the nutrient deficiencies. Management of SOM at its equilibrium (with climate) level therefore is one of the foremost frontal challenges of resource management in arid and semi-arid tropics.

¹Singh, H.P., et.al, Report of WG#2 - Sustainable Landuse Practices under NSC for Formulation of NAP, MOEF, GOI

6.8.1.2 Integrated Nutrient Management

Since no immediate improvement in the use of chemical fertilizers is likely to take place in rainfed areas, integrated nutrient management is the key to maintain the productivity of soils on a sustainable basis. Globalisation may eventually result in steep rise in fertilizer prices in the near future making them beyond the reach of small holders. Large number of experiments at research stations and on farmers' fields have demonstrated the importance of organics, Farm Yard Manure (FYM), compost and biofertilizers in supplementing the nutrient requirements of crops and providing stability to yields in rainfed areas (Subba Rao and Rao, 1980; Singh et al., 1999; Venkateswarlu and Wani, 1999). Fifty percent of the fertilizer N could be replaced with the use of FYM/compost in a variety of soils. Use of organic manures not only reduces the use of chemical fertilizer N requirement substantially in addition to supplementing important primary and secondary nutrients. The use of compost and FYM also improve the soils' physical condition and crop yields on a long term basis. In addition, it also improves the moisture holding capacity of spoils.

Availability of FYM in quantities adequate to obtain good response in field crops is a major limitation for wide adoption of this technology in rainfed areas. Consequently, alternate sources like green leaf measures and crop residues have been evaluated at a number of locations in India. Studies in Alfisols and Vertisols have indicated that upto 20 Kg N ha⁻¹ can be supplemented by following green leaf cover cum manuring technique through the addition of loppings of *Leucaena* or *Glyricidia*.

Sorghum stover in general cause a depressing effect on yields mainly due to the N immobilisation. Most areas in SAT ecosystem have a single kharif/rabi growing season. Double cropping could be possible in higher rainfall areas where a legume crop can be rotated to contribute in the maintenance of the soil fertility. In lower rainfall areas (350-700mm) there are little opportunities for producing green manure without competing with the main crop. Therefore, strategies for non competitive production of green leaf manures and their incorporation in the soil need to be evolved. Some such approaches tried at CRIDA and different locations of AICRPDA include bund farming where nitrogen fixing trees and bushes can be raised on either side of the field boundary bunds and the loppings incorporated in the soil. Yet another approach could be to raise a post-rainy season cover crop like horsegram/cowpea utilising the off season rainfall and ploughing it back into the soil before flowering (Katyal et al., 1994). A third approach tried at CRIDA is to raise leguminous trees or shrubs on marginal lands and incorporate the loppings in the nearby crop fields. Preliminary studies at CRIDA revealed that within two years *Leucaena leucocephala* grown on 0.25 ha of land could meet the N requirements of about 0.67 ha of sorghum crop. A minimum of two cuttings can be obtained in one season for incorporation in the crop field. This could be an excellent model of self-sustaining farming system in rainfed areas.

The other approach to enhance the use of organics could be the compost. This way animal manure (FYM) which is in short supply for use in rainfed regions can be converted into compost, increasing the bulk several fold yet the benefits remain the same or a shade better than FYM. Moreover, decomposed manure would make the nutrients more readily available to the existing crop. Considering the local market price of FYM, the cost of composting organic wastes (along with FYM) may be on par with that of pure FYM as the quantity of FYM gets reduced substantially. It has also been reported that termite infestation is much less when compost is used, compared to FYM.

6.8.1.3 Soil Quality Monitoring

Maintenance of soil health is critical for sustained agricultural productivity more so in rainfed areas. In view of the problems of land degradation and nutrient deficiencies, linking of soil quality with crop productivity is necessary on a continuous basis. Rainfall variability among years further compounds this relationship. Nevertheless, soil quality monitoring on a regular basis under different cropping systems/land uses is necessary in order to capture significant enhancements or deterioration in physical, chemical and biological properties over time. While changes in physio-chemical properties affecting soil quality have been reported adequately through land use experiments, little information is available on biological properties. Recent studies by Venkateswarlu (1998) across several dryland locations in SAT highlighted the significant effects of cropping systems and manuring practices on reversible and irreversible changes in soil microflora and its diversity. A number of parameters/minimum data sets have been identified for monitoring of soil quality. The essential difference between the existing LTFE experiments and the proposed soil quality monitoring lie in the integration of climate and crop productivity with soil quality in a dynamic model. To realise this, benchmark sites need to be identified. The agro-ecological zones identified by NBSS&LUP could be useful for selecting such locations. The soil health index developed at the Rhodale Institute in USA can be used as a starting point for research initiative in this context.

6.8.1.4 Assessment of Resource Status through Soil-Weather Modelling Approach

Strategies for sustainable rainwater management practices in SAT regions must consider long term data on the rainfall, soil loss and runoff. For better results, the total soil and crop management practices including tillage, crop choice, nutrient management and conservation measures need to be integrated. For designing such strategies some of these variables need to be predicted for a given agro-ecological condition. System modelling approaches can be successfully used for such predictions.

Based on the long-term experimental data, a number of models were developed to predict the effect of management/conservation practices on crop yields and resource losses. One such model, PERFECT-IND was used by Cogle et al. (1986) to assess the long term impacts of management practices on runoff, deep drainage and grain yield at two locations in Indian SAT (Hyderabad and Anantapur). PERFECT-IND was also used by Littleboy et al. (1996) to assess the impact of management practices, soil depth and slope on long term stability of soil productivity using rainfall data of Hyderabad. These approaches provide insights into the sustainability of the system, i.e., the rate of productivity declines, the soils that are most prone to such declines and the impact of tillage and management practices (Smith, 1998). Such innovations will find increasing application in future for devising Decision Support Systems not only for individual farmers but also for use at district/regional/national levels for guiding the development programmes oriented to resource management.

6.8.1.5 Permanent Vegetative Cover through Alternate Landuse Systems

Data generated at several locations in SAT ecosystem indicated that annual crops cultivated on land capability Class IV and above are prone to lower yields/risks, and lack of response to inputs. Soils in these capability classes can be best utilised for alternative land uses where self generating grasses, legumes and perennial woody tress constitute the major components. Agroforestry approach that includes systems like agrisilviculture, agrihorticulture, hortipasture and silvipasture can be successful as an alternate land use. Management of lands of lower capability through such interventions is the best way of integrating livestock

production in rainfed areas, thus contributing to the sustainability of the production system. Alternate land uses not only provide fodder, fuel wood and timber and fruits but also enhance the quality of resource base through greater biomass production and providing a land cover for most part of the year which constitutes the basic step for control of soil erosion by wind and runoff. Off-season rainfall which otherwise goes unutilised in single kharif cropping areas can thus be best utilised with such production systems. Trees also make the micro-climate more favourable to crop growth (Report of WG#2).

Multilocational studies under the AICRPDA and Agroforestry networks have led to the identification of the several agroforestry systems for different locations of the rainfed regions. In alley cropping, the perennial component is grown as hedge rows largely on contour lines, and the annual crop in the alleys. The prunings from the tree component can be used as fodder during drought years or applied in the cropped field as mulch cum manure. Although, the tree component competes with the annual crop for moisture and nutrients leading to decreased crop yields in drought years, the fodder from the tree supports the livestock. Moreover, by cutting the hedge rows, competition with the crop can be minimised. More studies on geometry and distance between edge and crop strips to minimise the competition are warranted. In areas where supplemental irrigation is possible, agrihorticulture provides significantly greater income than arable cropping. This system is suitable for SAT zones receiving 750mm annual rainfall and above falling in land capability class II and III. A number of fruit trees and the crop combinations have been identified and the water management techniques standardised.

Silvipasture has proved as an ideal land use system for marginal/degraded lands where a perennial tree component like *Leucaena leucocephala* is planned either with *Cenchrus ciliaris* or *Stylosanthes hamata*. Results from a 10 year old study on a class IV land at Hyderabad revealed that *Cenchrus ciliaris* can be established more successfully under grown up trees of *Leucaena leucocephala* than *Stylosanthes hamata*. Marginal land which otherwise are kept fallow can be utilised to raise improved pasture of *Stylosanthes hamata*/*Cenchrus ciliaris*. Such pastures can support upto 6 sheep ha⁻¹ in a continuous grazing system without any supplemental feed while the native pastures can support only 2 sheep ha⁻¹ (Singh et al., 1987).

Ley farming is another approach where a legume or a non-legume forage is rotated with cereals. This system improves soil quality besides providing fodder. In a four year study conducted at Hyderabad (annual rainfall = 750mm) on a shallow Alfisol (depth <45cm) raising *Stylosanthes hamata* in rotation with sorghum and castor improved the soil quality (organic carbon, total and available N) and resulted in increased yield of the following sorghum crop. Following is a traditional practice of recouping the soil health, but under dry SAT conditions Stylo rotation is significantly superior to fallowing. Moreover, fallowing would no longer be possible due to continuous population growth and progressive reduction in the size of the holdings. Ley farming can be successfully practised in a part of the holding every year. Stylo or grasses can be grown in two to four years period followed by arable crops. Through this cycle, the entire holding can be covered in 5 to 10 years depending upon the farmers' forage requirement and size of the holding.

In view of the long gestation period of tree component in agroforestry systems, a number of economic bushes as alternative like henna, curry leaf and Annette, etc., have been evaluated at CRIDA during the last 5 years. Preliminary results indicated that lands in capability III and IV can be utilised successfully by planting these bushes either sole or with short duration legumes like green gram or black gram. A two-fold

increase in net income could be obtained with this system compared to arable crops alone. For successful establishment of such species on marginal lands, a microsite improvement technology was developed and introduced to minimise post planting management costs and improve the survival and establishment of the plants. This involves digging a pit of 45×45×45cm size and filling with a mixture of native soil, tank silt, FYM and paddy husk. Significant improvement in soil moisture storage and survival of the seedlings was reported with this technology.

6.8.1.6. Alternate Land Use Systems for Different Agro-ecological Regions

In order to provide stability to farm income and also utilise the marginal lands for production of fodder, fuelwood and fibre, a number of alternate land use systems were evolved based on location specific experimentation and cafeteria studies (Singh, 1988). The general recommendations for alternate land use systems based on annual rainfall and land capability are outlined in Table 6.13. These systems are now being studied on-farm (PTD) to balance land capability with the farmers priorities, requirements and resources.

Table 6.13 Recommended alternate land use system options for different agroclimatic conditions.

Annual rainfall (mm)	Soil type	Land use systems	Suitable tree/grass/legume species
<500	Shallow (0-0.30m)	Tree farming	<i>Prosopis cineraria</i> , <i>P. juliflora</i> , <i>Acacia aneura</i> , <i>A. nilotica</i> , <i>A. tortilis</i> , <i>Pithecellobium dulce</i>
	Medium (0-0.45m)	Pasture management	<i>Lasiurus indicus</i> (light textured soils), <i>Cenchrus setigerus</i> , <i>Sehima nervosum</i> , <i>Stylosanthes scabra</i> , <i>Clitoria ternatea</i>
500-750	Shallow (0-0.30m)	Silvipastoral system	<i>Acacia nilotica</i> , <i>Colophosphermum mopane</i> , <i>Dalbergia sissoo</i> , <i>Hardwickia binata</i> , <i>Cassia sturti</i> , <i>Albizia amara</i> , <i>Leucaena leucocephala</i> , <i>Cenchrus ciliaris</i> , <i>C. setigerus</i> , <i>Dicanthium annulatum</i> , <i>Panicum antidotale</i> , <i>Stylosanthes hamata</i> , <i>Macroptilium atropurpureum</i> .
	Medium (0-0.45m)	Hortipastoral system	<i>Annona squamosa</i> , <i>Zizyphus mauritiana</i> , <i>Syzigium cumini</i> , <i>Embllica officialinis</i> , <i>Tamarindus indica</i> , <i>Feronia limonia</i> , <i>Aegle marmelos</i> , <i>Cenchrus ciliaris</i> , <i>Panicum antidotale</i> , <i>Urchloa mosambicensis</i> , <i>Stylosanthes hamata</i> , <i>Macroptilium atropurpureum</i> , <i>Clitoria tenatea</i> .
>750	Shallow (0-0.30m)	Ley farming or silvipastoral system	3 years <i>Stylosanthes hamata</i> and 4 th year arable crop (sorghum on heavier soils, pearl millet on lighter soils) Silvipastoral system as above.
	Medium (0.30-0.45m)	Ley farming or hortipastrol system	<i>Ley farming as above.</i> <i>Mangifera indica</i> , <i>Achras zapota</i> , <i>Psidium guajava</i> , <i>Emblica officinalis</i> , <i>Stylosanthes hamata</i> / <i>Macroptilium atropurpureum</i>
	Deep (>0.45m)	Agrisilvi or Agri-horti system	<i>Acacia ferruginea</i> , <i>Prosopis cinneraria</i> , <i>Tectona grandis</i> , <i>Hardwickia binata</i> , <i>Dalbergia sissoo</i> + arable crops. <i>Mangifera indica</i> , <i>Achras zapota</i> , <i>Psidium guajava</i> + arable crops

Source: Singh, 1988.

(i) Agri-silviculture: This system is recommended for soils in land capability Class IV with annual rainfall upto 750mm. A large number of tree-crop combinations, particularly of nitrogen fixing trees (NFTs) with sorghum, groundnut, castor and pulses were evaluated in Alfisols and Vertisols. Though the NFTs improve

the soil fertility, the excessive competition for moisture between the tree component and arable crops did not make this system popular with the farmers. However, *Faidherbia albida* and *Hardwickia binata* and green gram combine well with widely spaced (8m x 8m) *Faidherbia albida* trees. *Hardwickia binata* trees being erect and relatively slow growing did not compete with associated arable crops especially in the initial 8-10 years. Therefore, these two tree species hold promise for development of agri-silvicultural systems. Nevertheless, more research is required to find out ideal tree-crop combinations across AESRs/locations.

(ii) Silvipasture: This system is recommended for marginal soils (LCC V and higher). It involves integrating a tree component with a perennial legume or grass species as pasture. *Cenchrus ciliaris* and *Stylosanthes hamata* were extensively evaluated in different soil types and rainfall zones. *Stylosanthes hamata* is an improved pasture legume that can be raised on marginal lands and on field boundaries. For planting, seed @ 5 kg ha⁻¹ can be broadcast by mixing it with sand (1:5) with the onset of monsoon. A basal of 30 kg P ha⁻¹ has proved useful. The system can produce 3-5 t ha⁻¹ of dry fodder, second year onwards. Cutting of the fodder is recommended after seed setting to ensure self-seeding.

Cenchrus ciliaris is a widely adopted non-legume grass forage which comes up successfully in marginal lands. The seed rate for planting is 1.5-2 kg ha⁻¹ mixed with sand or pelleted and broad cast. In good rainfall years, 3-4 t ha⁻¹ of dry matter can be harvested in a year in two cuttings. In silvipasture system, *Cenchrus ciliaris* tolerates the competition from tree component better than the *Stylosanthes*. Therefore, in marginal lands the grass forage system is recommended along with the locally important tree component. On the other hand, *Stylosanthes hamata* can be independently established as a sole pasture on degraded marginal lands. This system has been widely adopted by hundreds of farmers in Rayalaseema area of Andhra Pradesh, North Karnataka, and Marathwada.

(iii) Agri-horticulture : In medium deep soil areas (LCC II to IV) receiving annual rainfall of more than 750mm, agri-horticultural systems consisting of a fruit tree intercropped with annual arable crop is recommended. *Ber* with clusterbean, cowpea, horsegram or other grain legumes has been widely adopted in the dry tracts of Andhra Pradesh, Maharashtra and Karnataka. Land treatment for collection of runoff and water harvesting techniques to provide supplemental irrigation during the summer months are critical to the success of this practice (Katyal et.al., 1994). Apart from prudent use of stored soil moisture, the water needs of fruit trees have to be effectively modulated by pruning. Custard apple and also pomogranate and aonla are other fruit crops suitable for this system.

(iv) Alley cropping : In this practice, arable crops are grown in alleys formed by the trees or shrubs, established generally on contours. This system is recommended for LCC II to III which receive 500-750mm rainfall. Trees or bushes grown in alleys act as live bunds and control runoff. Width of the alley and management of the tree crops are the key to success with this system. Long duration crops, however, suffer from yield loss due to competition. Therefore, the system could not become popular with farmers. Permanent alleys provide fodder during drought. However, there is a need to work out a suitable combination of alleys and crops in terms of choice of tree and crop species and spacing, etc.

6.8.1.7 Technologies for Soil & Water Conservation

(i) Soil and rainwater conservation Rainwater and soil management research has received maximum emphasis across the country during the last three decades with the following objectives:

- Integrate conservation and production technologies taking watershed as the unit of management
- Ensure maximum *in situ* rain water conservation
- Harvest runoff water for recycling as come-up supplemental irrigation and supporting establishment of tree crops.

High intensity rainstorms during monsoons cause significant loss of topsoil both in Alfisols and Vertisols. Gully and sheet erosion are the most common. A combination of mechanical, agronomic and vegetative practices can help in arresting soil loss and runoff in cropped lands. Usually, resource loss is more when lands are kept fallow (Table 6.14). Even crops differ significantly in their ability to arrest runoff depending on the canopy and the root system.

Table 6.14 :Effect of crop covers on runoff and soil loss on 3% land slope at Hyderabad

Crop covers	Runoff (% of rainfall)	Soil loss (t ha ⁻¹ yr ⁻¹)
Sorghum	12.0	3.0
Pearl millet	10.8	2.0
Castor	15.7	4.0
Cultivated fallow	16.6	5.0
Grass	9.5	0.6

Source : Sharma *et al.* (1982).

Mechanical measures like contour and graded bunding and bench terracing are designed for lands of different slopes as permanent structures which can be termed as 'hardware' treatments. Contour bunding in cultivated lands intercepts the runoff, reduces soil loss and provides increased opportunity time for water intake. This practice is useful in low rainfall areas (<600 mm) having soils with high infiltration/permeability rates. In Alfisols, contour bunding helps not only in controlling runoff but also increases crop yields, while it is not suitable for deep black soils due to prolonged water stagnation. Graded bunding is recommended for areas having higher rainfall (>700 mm) for safe runoff disposal. Adoption of these practices by the farmers has been dismal due to inherent limitations of small holders and in fact that such bunds cut across their field boundaries/holdings. As an indigenous system, the farmers install small holder bunds and mud-cum-pebble bunds across the slope to control moisture and to control erosion.

(ii) Inter-terrace land treatments: Inter-bund land treatments are of semi-permanent nature, primarily useful to minimise the velocity of overland flow. These practices have a significant role in checking of soil loss and ensure better utilisation of rainwater for crop growth. Land treatments like ridging, compartmental bunding, conservation furrows, broad-bed and furrows widely tried across the country are some such examples (Singh, 1998). While the advantages of such practices in resource conservation are demonstrated unequivocally, the yield gains depend on the quantum and distribution of rainfall in a particular year. Compared to the seed based technologies, the acceptance of these practices by farmers has been much less. Some of the important land configurations for inter bund treatments and their acceptance level by the farmers is given in Table 6.15.

Table 6.15: Recommended land configurations for field based rainwater management and their acceptance by farmers

Area	Rainfall	System of land configuration	Remarks
Alfisols (semi-arid)	Medium	Sowing across the slope and ridging the land between the rows with later inter-cultivation operations	Acceptable. Requires <i>desi</i> plough
Alfisols (semi-arid)	Low	Dead furrows at 2.4-3.6 m intervals	Found useful at research farms. Low cost technology requires vigorous testing on farmers' fields
Vertisols (semi-arid or sub-humid)	High	Broad bed and furrow with a bed of 100 cm and 50 cm of shallow furrow with a depth of 15 cm	Lack of economically favourable equipment. Insufficient draught power. Time consuming.
Vertisols (sub-humid)	High	Graded furrows at a grade of 0.2-0.3% and with a cross section of 0.1-0.15 m ² and spacing of 8-10 m intervals	Acceptance doubtful.
Vertisols (semi-arid)	Low	Contour farming	Acceptable, if replaced with cultivation across the slope
Vertisols	Low-Medium	Compartmental bunding	Should find favour for post-rainy season Sorghum
Inceptisols (sub-humid)	High	Interplot water harvesting of 1:1, 2:1 or 3:1 of corn:rice areas	Acceptance not very clear
Aridisols (semi-arid)	Low	Interplot water harvesting of 1:1 of cropped to uncropped land, the slope of uncropped area being on both sides	Good technology to harvest limited water to be used by cropped area
Aridisols (semi-arid)	Low	Interplot water harvesting of 1:1 of cropped to uncropped land, the slope of uncropped area being on both sides	Good technology to harvest limited water to be used by cropped area
Aridisols (semi-arid)	Low	Inter-row water harvesting with a treatment of ridges with runoff inducing substances like tank silt or polythene	Wide scale acceptance doubtful

Source: Katyal 1997.

More recently, a number of vegetative materials have been tried as barriers for control of runoff and soil loss at different locations in the rainfed region. These structures being porous, permit the runoff while retaining the soil and thus, overcome the problem of breaching. *Vetiver*, lemon grass, *glyricidia* and *Cenchrus* are some of the materials that have been evaluated with varying degree of success. While most barriers arrest soil loss and check the velocity of the overland flow, the yield improvements have been variable. Contour planting of vegetative barriers proved further beneficial in soil and water conservation (Table 6.16). Vegetative barrier, though a good approach has not been adopted by the farmer primarily because plants like *Vetiver zizanioides* (Khas) do not have much economic value. Thus, alternative plants need to be explored. *Lawosnia alba* (Henna, a plant from which a dye is extracted) could hold promise in this context. Studies on such alternatives are being initiated at CRIDA.

Table 6.16: Effect of vegetative barriers on the yield of crops at different locations

Location (mm)	Rainfall	Soil type	Treatment	Crop	Soil loss (t ha ⁻¹)	Yield (qtl ha ⁻¹)
Akola	830	Kharif & rabi black soils	•Planting across the slope • <i>Leucaena</i> barrier	Cotton	2.98	5.15
					1.10	6.12
Rajkot	625	Kharif black soils	• No barriers • Vetiver barrier	Groundnut	0.73	2.89
					0.42	4.46
Bangalore	890	Semi-arid red soils	• Control • Vegetative barrier	Finger millet	0.99	27.82
					0.85	30.53
Phulbani	1402	Sub-humid red soils	• Contour planting • Contour planting + vegetative barrier	Rice	7.57	13.30
					4.03	19.76
Hoshiarpur	1000	Sub-montane soils	• Control • Kana grass barrier • Control • Babbar grass barrier	Maize	65.4	26.3
					11.7	36.3
				Wheat	65.0	16.0
					11.7	17.4

Source: Compiled from annual reports of AICRPDA centres.

Soil and water conservation measures can also be used to sustain fruit trees in the dryland horticulture or horti-pastoral systems. A micro relief system developed at CRIDA was successful for *in situ* water harvesting and supporting acid lime and sweet orange under rainfed conditions. Micro-catchment relief system developed for Alfisols helped in stabilising the yield of citrus in drought years. In this system, small beds are created with elevation at the centre (20 cm height and 3 m wide). The water is allowed to run into the parallel rows of pits on both sides, to the planting basins. The surface of the ridge is covered with a thin layer of tank silt to seal the macro-pores and facilitate runoff.

(iii) Water harvesting and recycling In medium to high rainfall areas, despite following the *in situ* moisture conservation practices, rainwater surplus does exist that can be harvested and recycled. The advantages of storing harvested runoff in dug out ponds and utilising it for life saving irrigation of kharif crops and come up irrigation of rabi crops have been thoroughly researched and reviewed by Singh (1986); Singh and Khan (1999). The estimated potential volume of rainwater storage in small-scale water harvesting structures for different rainfall zones of the country is given in Table 6.19. On an average, 24 mha m of the total 400 m ha m of precipitation received annually in India is estimated to be available as harvestable runoff through on-farm water harvesting (Katyal 1997). The SAT regions falling in 500-1000 mm rainfall zone possess a harvestable runoff potential of 5.54 m ha m. Although village level water harvesting tanks have been traditionally in vogue in India, research during last 25 years has led to standardising the variables with respect to the catchment, size of the dugouts and utilisation of stored water (Singh 1986). However, constraints like seepage, surface evaporation and lack of proper water lifting devices coupled with cost of the dugouts hindered the adoption of this technology. Other factors such as soil type, slope also influence the harvestable runoff.

Table 6.17: Estimated potential volume of rainwater storage for small-scale water harvesting structures

Rainfall zone (mm)	Geographical area (m ha)	Rainfall for Effective surface Storage (%)	Harvestible runoff In water harvesting structures (m ha m)
100-500	52.07	5	0.78
500-750	40.26	6	1.51
750-1000	65.86	7	4.03
1000-2500	137.24	6	14.61
>2500	32.57	4	3.26

Source: Compiled from Singh *et al.* 2000

(iv) Tillage: Tillage has a marked influence on the conservation of soil and rainwater. These operations make the soil surface more permeable thus favour water intake. Deep tillage (25-30 cm) assists in opening up of the hard soil layers and faster penetration of rainwater. Deep tillage in problem soils promotes better root system development and thus higher yields in low rainfall years due to more efficient use of the sub soil resources. Off-season tillage or pre-monsoon tillage also has shown visible impact on weed control and rainwater intake. Soil moisture content is more at planting time if the soil is tilled in the off-season. Excessive tillage however is not beneficial. In sandy soils, it accentuates wind erosion. Excess tillage also does not permit build up of soil organic matter. Conservation tillage with residue recycling as practised in the west is partly responsible (besides the temperate climate) for building up of soil organic carbon; but such strategies may not be possible under Indian conditions because of competing use of crop residues as animal feed, weed menace and long dry period between two crop seasons. Therefore, minimum-yet-required tillage strategy which is appropriate to support good crop stand and contribute to soil organic matter build up due to less soil exposure to high atmospheric temperature regime, is needed to support sustainable agriculture in SAT regions.

(v) Mulching This include incorporation of organic wastes which also contribute to conservation of soil and rainwater. Studies across locations in the country demonstrated the usefulness of mulches in reducing evaporative water loss from soil surface. Mulching also reduced the runoff from cropped fields significantly and controlled weeds. This practice was generally more beneficial under receding moisture conditions for rabi crops than for kharif crops where intermittent high rains create micro-environment favourable for fungal growth. Mulching also had a favourable impact on the soil temperature at Hoshiarpur for rabi crops like wheat and resulted in 25 percent greater moisture storage in the 0-30 cm soil profile. For heavy black soils, vertical mulching is recommended to facilitate greater intake of rainwater. An increase of 25-30 percent was recorded in the yield in rabi sorghum at Sholapur and Bijapur when vertical mulching was done at 5 m interval. However, mulching in general has not become popular with the farmers obviously due to the operational constraints. Of late, work has been initiated on green material land cover (mulch) cum manure technique at different locations in the country. *Gliricidia/Leucaena* branches/loppings have been used as cover after planting and incorporated in the soil following canopy development. Encouraging results from this practice have been reported with respect to reduced soil loss, improved water intake, reduced evaporation and enhancement of soil quality. (Singh *et al.* 1998). The technique has shown positive signals for adoption. Communities need to be mobilised to plant such species on field boundaries.

(vi) Increase in Water Storage

- **Water resources development.** Creation of water conservation and storage structures led to improved water availability in terms of additional surface storage in check dams, water harvesting ponds and also greater recharge of ground water. The number of dug wells and the water table increased significantly in several situations.

- **Increase in cropping intensity.** The increased water availability in the open wells and *bundhis* led to increase in the cropping intensity. Additional area could be brought into cultivation and the irrigated area under the existing crops increased markedly. At some locations, double cropping became possible. The conservation measures also increased the rain water use efficiency. With assured water supply, high value crops replaced the traditional crops. A significant decrease in area under pearl millet and a corresponding increase in area under groundnut were reported in Alfisols of Karnataka due to watershed development. Based on the data from 14 model watersheds, a 50% increase in cropping intensity was recorded over a five-year period .

- **Improvement in productivity.** As a result of additional water availability and adoption of improved crop production technologies like HYV and recommended fertilizers, etc. a marked increase in the productivity of major crops was recorded between the base and terminal years (Table 6.18). There was also a significant increase in the fertilizer use. Yield benefits could also be seen when the productivity within the watershed area was compared with the neighbouring untreated areas. This was particularly evident in drought years.

Table 6.18: Productivity improvement in different crops in model watersheds.

Crops	Yield (kg ha ⁻¹) during				
	1983-84	1984-85	1985-86	1986-87	1987-88
Sorghum (10)	663	683	909	1008	1708
Green gram (11)	580	262	574	407	517
Groundnut (10)	414	507	007	981	1194
Sunflower (5)	-	338	815	524	429
Mustard (6)	-	393	599	577	443

Source: Singh, H. P. 2000 [Note: Figures in parentheses indicate the number of watersheds taken for averaging the yield.

- **Economic gains.** Marked economic gains were recorded owing to the implementation of watershed programme, which resulted from the additional water resource generation. The data presented in Tables 6.19 and 6.20 for Kolhewadi in Ahmednagar district of Maharashtra (a black soil) and Mittermari in Karnataka (red soils) highlight the impact of watershed programme. A substantial increases occurred both in the productivity of the crops and cropping intensity. High value crops replaced the existing ones when water became available. With increase in productivity and cropping intensity, the input use and investment increased providing greater employment opportunities in the watershed villages compared to the non-watershed villages.

Table 6.19: Economic Assessment of Watershed Dev. Programme in Kolhewadi, Maharashtra.

Cropping Season	Benchmark year	Watershed programme years		
	1984-85	1985-86	1986-87	1987-88
Kharif (rainy cropping season)				
Rainfall (mm)	174	154	203	118
Income/ha (Rs.)	865	1674	1061	1014
Rabi (post-rainy cropping season)				
Rainfall (mm)	281	259	96	185
Income/ha (Rs.)	960	1528	514	2078

Source: Umrani et al. 1989.

Table 6.20. Change in Area occupied by Major Crops due to Watershed Programme in Mittemari Watershed in Karnataka.

Crop/cropping system	Area covered (ha)	
	1983*	1988
Finger millet with intercrops	400	70
Groundnut with intercrops (mainly pigeon pea)	150	366
Sole groundnut	—	199
Others	33	28

Source: Singh, H. P. et al. 2000

6.8.2. Technologies specifically to control land degradation in different bio-climatic regions²:

- Arid
- Semi-arid and Dry Sub-humid

6.8.2.1 Technologies for Management of Land Degradation in Arid Region

The problem of desertification is severe in the arid zone especially in places which receive rainfall less than 250mm annually. Vast stretches of land are already out of cultivation here. There is however tremendous scope to arrest the process of degradation by adopting appropriate technologies. For example, management of inter-dunal plains can be brought under vegetative cover by *in situ* conservation of rainwater. Rain water harvested by induced catchment can be judiciously used to raise nurseries, to manage livestock and for life saving irrigation to tree crops. Since the harvested rainwater in arid regions is very precious, it should be used with utmost care. For instance, top priority should be given for drinking purpose for the livestock followed by raising of nurseries. Water if available in sufficient quantity can also be used for life saving irrigation for tree crops. Inter-dunal plains in some places are covered with local species of grass which are either overgrazed or dominated by non-palatable grasses. Such areas can be rejuvenated by using improved grass species, which help serve as fodder and also arrest erosion.

² Singh, H.P., et al., 2000-Report of WG#2 - Sustainable Agricultural Practices

In highly arid conditions inter-plot rainwater conservation practices are followed for *in-situ* rain water harvesting. It is evident from the indigenous knowledge of the farmers of Rajasthan that there are many traditional practices which ensure some crop, perhaps even fodder if not given even in the worst drought conditions. For instance, *Khadin* is one such system by which farmers in the hyper arid areas of Rajasthan grow at least one good crop during the year. *Khadins* are soil prockets in depressions along the course of natural drainage channels. Runoff water in depression is stored constructing a bund across the flow. Water thus collected is allowed to percolate after which an assured post-rainy crop is grown. *Khadin* also recharges the dugwells and enhances the ability of drinking water particularly in winter and summer months.

Sandy soils and poor vegetation are the basic characteristic features of arid regions. Movement of sand through wind action is a major hazard in these areas. Strategies to control land degradation therefore should focus on control of wind erosion as a basic step, as detailed below:

(i) Control of wind erosion Wind erosion can be controlled either through mechanical and chemical methods of sand stabilisation, or through vegetative measures. Mechanical and chemical methods have not been found feasible in India, but were tried successfully in some localities for non-agricultural activities (e.g., for protection of gas pipeline in west Jaisalmer (Kar *et al.* 1994). Some simple methods of mechanical sand control suitable for Thar desert, and their underlying principles have been described by Kar (1996b). Mechanical control measures are, however, site-specific and need periodic monitoring, as the solutions are not permanent. Research and development activities at CAZRI since 1953 have perfected the methods of vegetative control of wind erosion (Bhimaya and Kaul 1960; Ganguli and Kaul 1969; and Kaul 1985). The major technological interventions in this context are stabilisation of shifting sand dunes and shelterbelt plantation.

(ii) Stabilisation of sand dunes: As discussed earlier, the old dunes have greater stability and mostly cultivated. The new dunes are highly mobile and devoid of vegetation. Much of the sand dune Stabilisation programme is directed towards the old dunes, so that the production potentials of these lands can be restored. The activities include (a) protection of the area from human and livestock encroachment; (b) creation of micro-windbreaks on the dune slopes, using locally available shrubs either in a checker board pattern

Table 6.21. Plant species suitable for sand dune Stabilisation in the Thar desert, India.

Annual rainfall Zone (mm)	Trees	Shrubs	Grasses
150-300	<i>Prosopis juliflora</i> , <i>Acacia tortilis</i> , <i>Acacia seneged</i>	<i>Calligonum polygonoides</i> , <i>Ziziphus nummularia</i> , <i>Citrullus colosynthis</i>	<i>Lasiurus sindivus</i>
300-400	<i>A. tortilis</i> , <i>A. senegal</i> , <i>P. juliflora</i> , <i>Prosopis cineraria</i> , <i>Tecomella undulata</i> , <i>Parkinsonia aculeata</i> , <i>Acacia nubica</i> , <i>Dichrostachys glomerata</i> , <i>Colophospermum mopane</i> , <i>Cordia rothii</i>	<i>Ziziphus mauritiana</i> , <i>Z. nummularia</i> , <i>C. polygonoides</i> , <i>C. colosynthis</i>	<i>Cenchrus ciliaris</i> , <i>C. setigerus</i> , <i>L. indicus</i> , <i>Saccharum munja</i>
400-550	<i>A. tortilis</i> , <i>P. cineraria</i> , <i>P. juliflora</i> , <i>A. senegal</i> , <i>Dalbergia sissoo</i> , <i>Ailanthus excelsa</i> , <i>Albizia lebbek</i> , <i>P. aculeata</i> , <i>T. undulata</i> , <i>D. glomerata</i> , <i>C. mopane</i>	<i>Z. mauritiana</i> , <i>Cassia auriculata</i>	<i>C. ciliaris</i> , <i>C. setigerus</i> , <i>S. munja</i> , <i>Panicum antidotale</i>

Source: Venkateswarlu (1993).

or in parallel strips; (c) direct seeding or transplantation of indigenous and exotic species; (d) plantation of grass slips or direct sowing of grass seeds on leeward side of micro-windbreaks; and (e) management of revegetated sites (Kaul 1985; Kaul 1992). Bio-fencing, using locally non-palatable species, is a cheaper and more effective form of barrier.

(iii) Shelter belt/wind break plantation Experience suggests that across-the-wind plantation of a 13 m wide tree belt, interspersed with 60 m wide grass belt, provides the best results. Establishment of micro-shelterbelts in arable lands, by planting tall and fast-growing plant species such as castor bean on the windward side, and shorter crops such as vegetables in the leeward side of tall plants helped to increase the yield of lady's finger by 41%, and of cowpea by 21 percent, over the control (Venkateswarlu 1993). In spite of the good results the community shelter belts in arable lands are not very popular with the farmers, especially as the technique normally cut across their fields/holding boundaries. Therefore, of late, it has been suggested to plant trees on field bunds across the direction of wind (Ganguli and Kaul 1969; Venkateswarlu and Kar 1996; Singh *et al.* 1987).

(iv) Management of pastures and range lands As stated earlier, among the different land use units in the rainfed agro-eco-system, the permanent pastures are the most degraded and neglected. In many instances these are devoid of even the basal vegetation cover. Since the land does not belong to any individual, there is no concern for it. Overgrazing and other forms of destruction of natural vegetation, as well as encroachment, have increased so much that other poor communities have largely replaced the original plant communities. In order to reverse the process, a serious and sustained effort (perhaps even legislation) is warranted. In the arid areas, pelleted seeds of grasses such as *Lasiurus indicus*, *Cenchrus ciliaris* and *Cenchrus setigerus* may be planted. Such simple interventions can increase the carrying capacity of an average permanent pasture from 2.5 sheep ha⁻¹ to as much as 4.5-6.9 ha⁻¹ sheep in sandy soils and 9.0-13.8 ha⁻¹ sheep in loamy sand soils (Abrol and Venkateswarlu 1995). Multipurpose trees and shrubs such as *Prosopis cineraria*, *Ziziphus nummularia*, *Capparis decidua*, and *Acacia nilotica* are suitable for silvipasture. The areas marked for development need to be protected from grazing for at least two years. The controlled rotational grazing can then be introduced. Community mobilisation is thus the central issue. Farmers may be encouraged to establish pastures on part of their holdings (short and long-term/degraded fallow lands) to decrease the pressure on village commons. The size of pasture may depend on the individual requirement and holding size. The approach, however, should be integrated with research and development in complimentary sectors. This may include replacing the large herds of poor quality animals with improved quality livestock of smaller number, which can be sustained in arid and semi-arid rainfed environments, improving grazing land management/stall feeding, improving the fuel energy situation, people's willing participation, and even legislation, if absolutely required and practical. Dynamic models need to be developed that help to identify the appropriate balance between the resilience of vegetation to short-term overgrazing, the variability in the weather overtime, the indebtedness of herdsmen and their attitude to risk.

6.8.2.2. Semi-arid and Sub-humid Regions

Conservation of soil, efficient management and utilisation of rainwater and management of the non-arable lands for fodder, fruit and fuel wood production in the watershed perspective are the core strategies of natural resources management in the semi-arid tropics and in the dry sub-humid regions. Research programs during the last 25 years have focused on evolving specific strategies for improving productivity through a judicious blend of land, water and crop management practices.

6.8.3 Technologies for Management and Reclamation of Degraded Lands³

6.8.3.1. Technologies for Management of Soil and Water Erosion

Areas covered by **shallow ravines** can be utilised for silvipasture which will also encourage livestock enterprise. Aerial seeding of grasses of improved strains like Marwar Anjan and 358 of *Cenchrus ciliaris*, Marwar Dhawan, 175 & 296 of *Cenchrus setigerus* etc. may also be tried to reclaim the shallow ravines. Erecting mechanical checks and stabilisation of ravine slopes wherever possible should be taken up to prevent further degradation (Singh and Singh 1999).

6.8.3.2 Technologies for Rehabilitation of Mine spoils

One of the major constraints in the rehabilitation of mine spoils particularly in arid regions is the very poor status of plant nutrients in the overburden/mine dump. Higher pH, and exchangeable sodium, magnesium, sulphur, and phosphorus, as well as salinity-alkalinity build-up are the other constraints in many mine spoils (Saxena and Chatterji, 1995). Revegetation of the mine spoils is, therefore, a challenging task. CAZRI has attempted to revegetate a limestone mine spoil area to the south and a gypsum mine spoil area to the east of Jodhpur with some success. Saxena et al. (1997) listed the suitable tree, shrub and grass species for rehabilitation of different kinds of mine spoils. For example, gypsum, bentonite, Fuller's earth, and clay mine areas can be rehabilitated with species such as *P. juliflora*, *Salvadora persica*, *A. tortilis*, *Albizia amara*, *Parkinsonia aculeata*, *Dichrostachys nutans*, *C. decidua*, *Desmostachya bipinnata*, and *C. ciliaris*.

In areas under **mine-spoils** and **quarry based** which are permanently out of cultivation, the erosion rate of the mine-spoils is known to be about 1000 times more than that of the normal soils. Mine-fillings and quarry wastes are a hazard as the surface runoff brings the mine and quarry wastes into the territory of fertile/cultivable soils thereby rendering them unfit for cultivation. Therefore, there is an urgent need to address the areas covered by mine-spoils and quarry wastes by taking up tree planting on a massive scale. This will help prevent surface runoff in the affected areas.

As apparent from the above the overall goal of the process of desertification control should not only address issues relating to halting of the degradation but also those concerned with bringing the already degraded land back into productive use. It can be targeted to reclaim in the next two decades about 50m ha of the severely degraded lands for productive use in agriculture/other usage. This will go a long way in ensuring the food security in the next 4 decades - the time-frame which is expected to be most critical due to increasing population.

Long-term measures also include structures which are erected to regulate overland flow and reduce peak flow. These structures aim at improvement of relief, physiography and drainage features of watershed areas on macro scale, say 2000-5000ha. The assets created under long-term measures are of permanent nature and need investment. Hence, these should be initially taken up with the Government funding but with peoples participation on a watershed scale, wherever applicable.

³ Singh, et.al. 2000- Report of WG#2-Sustainable Agricultural Practices.

6.8.3.3. Technologies for Management/Utilisation of Industrial effluents

Researches suggest that there is some scope for recycling the toxic industrial effluents and use the water for biomass production, although initial cost and other factors may appear limiting. Das and Kaul (1992) listed the tree species which can be successfully grown with different kinds of industrial effluents, from dairy, textile, tannery, and thermal plants. However, considering the fact that there may be some risk of heavy metals and other toxic/undesirable elements contaminating the plants and then moving into the food chain, utmost care is necessary in the use of such waters.

Aggarwal et al. (1994) identified nine tree species that can be grown with textile effluent water in the arid areas. These are *E. camaldulensis*, *Acacia nilotia*, *A. tortilis*, *Azadirachta indica*, *Hardwickia binata*, *Colophospermum mopane*, *Prosopis cineraria*, *P. juliflora*, and *Tecomella undulata*. The major prerequisites are: (i) addition of gypsum and farm-yard manure at the rate of 5 kg per pit, and (ii) adoption of a double ring method for irrigation, where the irrigation is done in the outer ring, i.e. away from the sapling. Further, in-depth studies are underway to develop cost effective technologies for utilization of industrial effluents.

6.8.3.4. Technologies for Management of Salt Affected Soils/Water logged Areas

Management of Salt affected areas need to be addressed with proper technologies to regain their lost productivity. Salt affected land lying in low rainfall areas should be focused for silvipasture development while those lying in high rainfall areas can be considered for rice cultivation with suitable amendments and varieties. Much of water logging and salinity-alkalinity hazard is associated with inappropriate water management. This can be partly countered by vertical and horizontal sub-surface drainage, as has been done in parts of the alluvial soils of Haryana and black soils of Karnataka (Abrol and Gupta, 1990; Rao and Singh, 1990). Lining of canals, judicious use of canal water (using sprinkler and drip irrigation techniques), and efficient management of command areas are necessary to arrest further degradation of land resources.

The sodic soils so widespread in the country can be reclaimed or moderated by the application of gypsum. The requirement of gypsum has been standardized. With proper choice of crops only the upper 15cm of soil needs to be amended by application of gypsum (Khosla et al. 1973). Extensive data have since been generated over the years on the beneficial effects of gypsum application on salt affected soils (Table 6.22).

Table 6.22: Effect of gypsum doses applied for 3 years on crop yields (t ha⁻¹).

Gypsum (t ha ⁻¹).			Mean grain yield (1971-72, 1973-74)	
I year	II year	III year	Rice	Wheat
6.5	-	-	7.01	4.33
6.5	6.5	-	6.40	3.98
6.5	6.5	6.5	7.46	4.16
13.0	-	-	6.64	4.51
13.0	6.5	-	7.04	4.35
13.0	6.5	6.5	7.24	4.50
19.5	-	-	6.92	4.62
19.5	6.5	-	7.31	4.72
19.5	6.5	6.5	6.96	4.57
26.0	-	-	7.20	4.69
26.0	6.5	-	7.24	4.89
26.0	6.5	6.5	7.14	4.17

Source: Khosla, et.al. 1973

The other amendments useful for reclaiming salt affected soils include pyrite and organic manures. For instance growing of *Sesbania acculeata* (dhaincha) is well known to reclaim sodic soils in north-western parts of India. Application of gypsum and farm-yard manure in the sodic soils of Haryana led to better growth of *Casuarina equisetifolia*. In arid Rajasthan irrigation with water having residual sodium carbonate (RSC) is a major source of soil sodicity. Studies in the RSC water-degraded soils indicate that irrigation with waters of RSC of 7.1-8.8 me l⁻¹ can rehabilitate the soil if it is treated with gypsum at the rate of 100% soil gypsum requirement plus an additional quantity of gypsum to neutralize the excess RSC in irrigation water (Joshi and Dhir, 1991).

Network research has further resulted in identification of crops and varieties that can tolerate salinity and alkalinity. Usually the crops that can withstand excess moisture conditions can also tolerate sodicity. For highly degraded salt-rich soils of Haryana 14-15 t ha⁻¹ of gypsum is required for rice-wheat rotation, in which the cultivation of rice by itself is a reclamation measure (Abrol and Gupta, 1990).

A number of afforestation and agroforestry techniques are now available for rehabilitating the salt-affected soils (Gill et al., 1990). Tree species such as *Prosopis chilensis*, *P. juliflora*, *Tamarix troupii*, *Tamarix aphylla*, *A. nilotica*, *Acacia auriculaeformis*, *Casuarina obesa*, *C. equisetifolia*, and *Eucalyptus camaldulensis* are highly tolerant of soil salinity thus suitable for plantation in such areas.

6.8.3.5 Technologies for Reclamation of Waterlogged Saline Soils

Saline soils are often associated with water logged areas due to the rise in the water table. Surface stagnation of water in these soils is a serious problem during monsoon. Cost effective measures for managing surface and sub-surface drainage are the key to minimise the adverse effects of water logging/soil salinity. It is estimated that in India, area with high water table is about 2.6 mha, while about 3.4 mha suffers from water stagnation. Following are some of the measures for reclaiming water logged saline soils:

(i) Drainage management : Based on 10 year field study of sub-surface drainage in Haryana, design criteria for sub-surface drainage for water logged saline soil representing alluvial plains have been standardised. Field studies further indicated that desalinisation of the soils under sub-surface drainage was achieved through the rainwater that was conserved in the field by providing strong bunds (Singh and Pandey, 1991).

(ii) Irrigation system improvement : Drip and sprinkler irrigation can increase the water use efficiency by 70-80% in contrast to conventional system of surface irrigation with unlined field channels which have an efficiency of 20-30% only. Improvement in the conventional methods by borders/furrow irrigation and brick lined water courses had an efficiency of 40-60%. These improvements can bring down the rate of secondary salinisation by irrigation water.

(iii) Disposal of drainage effluent : Sub-surface drainage systems produce poor quality drainage water which needs to be disposed off carefully. This problem is imposing restrictions on the reclamation plans using sub-surface drainage system on about 0.4m ha in Haryana which is potentially productive but for water logging and salinity. Feasible alternatives for use of high salinity drainage water by blending it with canal water need to be worked out as a strategy for managing saline drainage effluents.

(iv) Agronomic practices for managing salinity/alkalinity : About 25% higher seed rate over the normal is recommended to account for mortality of young seedlings and poor tillering of crops in salt affected soils. Heavy irrigation is recommended before sowing to leach down the accumulated salts so as to improve germination and initial growth of the crops in such soil conditions.

6.8.3.6 Alternative Land Uses for Salt Affected Soils

Suitable tree species such as *Prosopis juliflora*, *Acacia nilotica*, and *Tamarix articulata* are recommended for plantation in salt affected soils. Long-term field studies indicated that growing leguminous tree species such as *Prosopis Acacia*, *Casuarina*, etc. can help ameliorate alkali soils at much faster rate than non-leguminous trees because of formers' ability to build-up soil N/organic matter status. Growing legume trees in highly sodic soils can contribute in their amelioration for crop production, in future.

Grasses in general are more tolerant to alkali conditions than most field crops. Promising grasses in alkali soils are *Leptochloa fusca*, *Chloris gayana*, *Brachiaria mutica*, and *Cynodon dactylon* (Kumar and Abrol, 1986). Other promising grasses for utilisation of saline soils are *Aeluropus lagopoides*, *Chloris barbata*, *Echinocloa colonum*, *Dicanthium annulatum*, *Phragmites* and *Sida* spp.

6.8.3.7 Agroforestry for moderately alkaline soils/reclaimed soils : Promising trees for agroforestry on moderately sodic soils or the reclaimed ones are *Populus deltoides*, *Eucalyptus tereticornis*, *Acacia nilotica* and *Tectona grandis*. *Populus*-based agroforestry system has proved more remunerative due to faster growth and better market price. Intercrops such as rice-berseem and rice-wheat can also be taken during the initial period of tree growth.

Horticulture : Promising fruit tree species such as *Zizyphus mauritiana* (ber), *Psidium guajava* (guava), *Punica granatum* (pomegranate), *Embllica officinalis* (amla), *Carissa carandum* (karaunda), *Tamarindus indicus* (imli), and *Syzygium cumini* (jamoon) can be grown in highly alkali soils by adopting proper site modification technology including the use of organic and inorganic amendments.

Case studies on Control of land degradation by adoption of integrated watershed approach Bringing the entire arable and non-arable (community land) area (which otherwise would have remained barren and subject to degradation) under productive utilization, is the key to control land degradation. Since water is central to any agricultural, horticultural, silvicultural or pastoral activity, it is vital to conserve and utilize rain water based on the terrain hydrological unit i.e. watershed. The essential components of watershed development approach are:

- Efficient conservation of rainwater through comprehensive land management techniques, adopting a cost-effective mechanical and vegetative blend of conservative structures.
- Adoption of improved crop management technology.
- Development of alternate land use systems for different land capability classes for stabilising and maximising productivity of otherwise unproductive lands.

During the Sixth Plan, the MOA, DAC launched a scheme entitled "Propagation of Water Conservation/ Harvesting Technology for Rainfed Areas" at 19 locations. The MORD also adopted this scheme and implemented it at 43 locations. These 43 watersheds were provided technical support by ICAR institutes and SAUs. Subsequently, these successful watersheds were known as "Model watersheds". This scheme paved the way for the launching of the NWDPRAs and the IWDPRAs.

6.8.4 Traditional/Indigenous Technologies for Combating Desertification

Traditional knowledge and practices have their own importance as they have stood the test of time and have proved to be efficacious to the local people. Some of these traditional practices in the fields of agriculture - crop production, mixed farming, water harvesting, conservation of forage, combined production system, biodiversity conservation, forestry, and domestic energy, to mention a few. These are briefly described below.

6.8.4.1. Traditional/Indigenous Technologies in Agriculture⁴

(i) Crop production

The tank system is traditionally the backbone of agriculture production in semi-arid region. Tanks collect rainwater and are constructed either by *bunding* or by excavating the ground. It is estimated that 4 to 10 ha of catchment is required to fill one ha of tank bed.

In the Thar Desert, traditional systems of land and water use met environmental challenges in various ways. The limited crop-growing season led early inhabitants to rely on animal husbandry and farming of hardy millets in the summer season. However, one group of indigenous cultivators (*Paliwals*) devised a rainwater-harvesting technique fully capable of growing winter season crops.

As early as the 15th century, the *Paliwal* cultivators followed a unique practice of water harvesting and moisture conservation in suitable deep-soil plots. These plots as also surrounding catchment area were developed with care and managed to make the system a self-contained unit for winter cultivation. Under conditions of intense evaporation, the moisture threshold and soil fertility was maintained. The total energy input, rainwater, sand-silt-clay accumulation, and the cultivator's own activities were interwoven into a complete production system of winter crops. There was a progressive increase of yields every year as more and more fresh silt, clay and humus accumulated and widened the vertical and horizontal dimension of such plots. The ratio of farmland and catchment area was regulated to be 1:11 so that the critical supply of moisture was maintained (Tewari 1988). This is known as the *Khadin* system of cultivation. In this system, the nearby uplands and rocky grounds are also used as catchment for collecting rainwater. There are still as many as 500 big and small *khadins* covering a total area of about 12,140 ha (Kolarkar 1980). Another indigenous system known as Achar and Pine suited to low lying areas of Bihar was developed.

In Tamil Nadu, the practice of *nangai-mel-pangai* (dry crops on wetlands) was common. If the monsoon seemed not to be promising at the planting time, farmers would plant high quality dry crops, usually *ragi* or *cholam* (varieties of millet), under tank irrigation. If the season looked good, they would plant paddy.

In Central India, a very old cultivation system based on water harvesting and runoff farming in the Narmada valley locally known as *haveli* still exists. This system is location specific, like other indigenous runoff farming systems of the country. It is practiced in areas with black cotton soil. Fields are embanked (average height of embankment being 1 m) on four sides. Rainwater remains in the field until the beginning of October. A few days before sowing *rabi* (winter) crops, the excess water is drained off. Water is let out very gradually. The cultivators know from long experience which field ought to be drained first. The water from one field enters into another, and then another till it joins the natural drainage or lake. There is a mutual understanding amongst the farmers as to when to release the water. *Bhil* tribals developed another system called *patt*. The principle of this system is simple and comprises *bunding* (embankment) of a stream at a point to provide a

⁴ Kaul, RN, 2001- Draft Report on NAP to Combat Desertification dated 25th January 2001.

static head of 30-60 cm, sufficient to divert water into the irrigation channel. The gradient of the channel is less than the gradient of the streambed and climbs to a height varying 3-25 m. This system allows double cropping.

(ii) Mixed farming

The bulk of natural resource base of the arid region is most suited to pasture based livestock farming. The traditional wisdom of the dryland farmer clearly manifest in the evolution of system of mixed farming – including crop and animal husbandry – which matched the potential and limitations of the natural resource base (Jodha and Vyas 1969). The misuse of land, namely ploughing the lands best suited to natural grasses was rectified by the practice of crop and long fallows (bush fallow) rotation.

Table 6.23: Summary of Indigenous Technical Knowledge (ITK) in Rainfed Farming

PURPOSE/OBJECTIVE	TECHNOLOGY	AREAS/REGIONS WHERE IN USE
1. Soil and Water Conservation		
In-situ moisture Conservation	Deep ploughing during summer for efficient capture of early showers	Black soils of Maharashtra
	Pre-monsoon blade (local) harrowing for breaking surface crust for efficient trapping of early showers	Red soils of Andhra Pradesh
	Short term fallowing during mid May and June to conserve early rains	Red soils of Anantpur, Andhra Pradesh
	Furrowing as a part of seeding operation in sorghum and castor	Ranga Reddy Dt. Andhra Pradesh.
	Cross ploughing in standing crop of castor	Nalgonda District, Andhra Pradesh
	Repeated ploughing and planking of soil to conserve available soil moisture for rabi wheat	Shivaliks of Hoshiarpur district of Punjab
	Shallow interculture in rabi sorghum to minimise soil cracking	Deep black soils of Bellary, Karnataka
Harvesting of runoff water: Construction of kuntas	Construction of small size community ponds (Kuntas) in high rainfall areas (> 1000 mm/annum) for providing supplemental irrigation to rainfed paddy during long breaks in rainfall. Water from these ponds is also used for transplanting of chillies and tobacco.	Prakasam and GUNTur, Andhra Pradesh. Nizambad, Andhra Pradesh
Percolation tanks	In medium rainfall areas, the percolation tanks are used for recharging the underground water to bring stability in rainfed agriculture.	Andhra Pradesh, Karnataka, And Maharashtra
Construction of Khadins	Earthen embankments are constructed across the drainage lines/gulies rocky/gravelly areas to hold rainwater in depressions having soil pockets. Assured crops (wheat and mustard) are grown in Rabi season following the seepage of the standing water.	Jaisalmer, Jodhpur and Bikaner districts of Rajasthan
Haveli system	Haveli system is storing rain water by raising field bunds used in kharif fallows. Water is let out in pre-rabi to grow assured rabi crops.	Madhya Pradesh (Bundhel Kahand)
Risers (stone bunds)	Stone pitching of bench terrace risers to conserve rainwater.	North east hilly regions
	Planting of various vegetative materials like <i>Ipomea</i> species and babbar grass to control landslide.	North east hilly regions
	Raising of cactii, agave, <i>Ipomea</i> , <i>Jatropha</i> , etc. on field boundaries as live fence.	North east hilly regions

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Stone pitched barriers	Stone pitching along with stubbles of pigeon pea/sorghum/cotton across the slope for conservation of rainwater	Vidarbha region
	Field bunds with waste weirs, stone checks and boundaries to conserve rainwater	Black soils, low rainfall areas of Karnataka, Andhra Pradesh, & Gujarat
	Construction of "Kayyalas" (boulder walls) around field boundaries	
Vegetation on bunds	"Kana" bundhies supported by locally available grasses for <i>in situ</i> water harvesting in desert areas.	Arid areas of Rajasthan
2. Cultural Practices		
Mixing of sand with small seed crops	Mixing of sand with seeds of sesame and tobacco for sowing to ensure uniform plant stand	Southern parts of Andhra Pradesh
Early sowing of kharif sorghum in Rohini karthi and delayed sowing of castor in Arudra karthi	This practice avoids the incidence of shootfly, earhead bug.	Telangana region of Andhra Pradesh
Compact block cultivation of same crop	The rationale behind this practice is to minimise the risk due to bird damage in sensitive crops like sorghum, maize, millet, sunflower, etc. when planted in compact area.	Andhra Pradesh, Maharashtra
Sakehar sowing of maize	Dry sowing during May to first fortnight of June. Delay in sowing results in drastic yield reduction. The seeds are sown deeper and planking is done after rains.	Palampur region of Himachal Pradesh.
Bushening in paddy	Ploughing in dry sown paddy in standing water at 25-30 DAS. This practice is being followed to suppress the weeds and thinning of plant density.	Orissa
Use of Bana plant twigs in paddy fields	Pegging 5-10 bana twigs in canal area after transplanting/halod in paddy field to protect the crop against endemic diseases and insect pests.	Himachal Pradesh
Spot application of FYM	Application of FYM in seeding furrows to avoid crusting and conserve moisture in cotton	Vidarbha region
Intercropping	Intercropping chick pea with mustard to minimise risk (frost damage to mustard and damage due to drought to chickpea)	Uttar Pradesh and Haryana
Tillage (plough-plant for bajra)	Tillage and planting is done with one single operation with Tyne cultivator. Spacing is kept at 25-30 cm so that primary tillage is adequate and weeds are removed.	Western Rajasthan
Control of surface crusting for bajra	Seeds of mung/cowpea are mixed sown with bajra. These legumes are able to break the crust for emergence and pave way for bajra seedlings to come out. Otherwise small seeded bajra crop cannot break the crust on its own.	Western Rajasthan
Improvement of pegging/pod development in groundnut	Sand from river/stream (nearby) is mixed in the seed bed @ 20-25 t/ha once in 3 years (red soils)	Anantpur district of Andhra Pradesh.
Seed bed improvement for groundnut	The crop is planted on set rows every year. Manures and fertilisers are applied on the rows only. Hence, soil fertility and water retention capacity are enhanced/maintained with relatively lesser application of these inputs.	Surashtra region of Gujarat
Agroforestry	Growing of Palmyra trees in between crop plants, eg., palmyra palm in combination with sorghum/pearl millet/cotton/groundnut/pulses	Penninsular India towards the coastal zone.
	Planting tamarind trees on field boundaries	Southern parts of India
	Growing of sunflower/pulses with Kapok tree which gives high quality fibre.	Southern parts of India

Chapter 6 Measures to Combat Desertification and Mitigate the Effects of Drought

	Growing of crops (cereals and pulses) in existing stand of Khejri (<i>Prosopis cineraria</i>), local Ber, <i>Acacia Senegal</i> , Babul tree (<i>A. nilotica</i>). Farmers know that these trees do not compete with crops and hence these trees do not compete with crops and hence yield of fodder, fruit and timber comes a bonus.	Western Rajasthan Telangana region of A.P
	Custard apple with cereals and pulses	
	Planting of crops (moth, bajra) in the existing stand of seven grass (<i>L. indicus</i>). In case of crop failure, seven provides good fodder for livestock which constitutes an important component of the production system in the region.	Bikaner (rainfed), Western Rajasthan
4. Pest Management		
• Setting of biological traps to control red hairy caterpillar in castor	Spreading twigs of <i>Calotropis</i> and <i>Jatropha</i> on the field boundaries. The larvae of the pest (red hairy caterpillar) while leading on the traps can be collected and destroyed with kerosene.	Medak and Nalgonda districts of A.P.
• Sprinkling of cooked rice to control semilooper in castor	Sprinkling cooled rice and other foodgrains in the fields in the month of July to attract birds/predators to control semilooper. Further, the crop of castor is isolated from sorghum to minimise the incidence of root-wilt in castor.	Castor growing areas of A.P.
• <i>Spondoptera</i> in groundnut	Castor is grown as a trap crop to control <i>spondoptera</i> Bird perches are used to create a resting place for birds to control natural pests.	Warangal district of A.P. East Godavari district of A.P.
• Control of <i>Helicoverpa</i> in sunflower	Thorns are used to pick up the caterpillar manually to reduce the yield loss.	Rayalaseema region of A.P.
	Thorny bushes are run on the canopy of groundnut to reduce the incidence of leaf minor in groundnut and also control of <i>Helicoverpa</i> in sunflower	Telangana region
• Use of organic pesticides	Spray of neem + garlic and <i>Bougainvillea</i> extracts to control pod borer in <i>pigeonpea</i> .	Mahaboobnagar and Kurnool districts of A.P.
• Control of aphids in pulses and black smut disease in sorghum	Application of tobacco decoction mixed with soap emulsion to control aphids.	Many parts of the country.
5. Risk Distribution Farming		
Rainfall		
• Fluttering of feathers by cockerel	This is taken as an indication of good rains to prepare for tillage and seeding operations for rainfed crops	Dry region of A.P.
• Receipt of rains in Arudrakarhi (2 nd fortnight of June)	Sowing of crops during this period is expected to give good crop yields of all rainfed crops except cotton.	A.P.
• Sowing of sesame in Bharani karhi	Sowing of sesame in Bharani karhi is supposed to lead to very good yields.	Coastal dry regions of A.P.
• Emergence of winged ants	Emergence of winged ants is considered as an indicator of commencement of rains.	Vidarbha region
• Crop diversification	In rabi cropping mustard and chickpea are given equal consideration. The frosts in December-January may damage mustard but not chickpea. On the other hand, the terminal drought may heavily reduce the yield of long duration crop of chickpea without having much effect on mustard.	Haryana
	Cultivated area is distributed under green gram, sorghum and cotton. Heavy rainfall that may occur during July/August may completely destroy the green gram without much effect on sorghum. Terminal drought may adversely affect cotton but not green gram/sorghum. Hence risk is reduced.	Vidharbha region of Maharashtra

Source: ICAR, 1999

6.8.4.2 Traditional Water Harvesting Systems

India has a rich history of use of traditional systems of water harvesting in almost all the States. Conservation of both surface and groundwater has been an integral part of India for many centuries. Archaeological records are available of their use by ancient civilizations in India. In fact, ponds and tanks represent an important community resource for drinking water in rural India even today. The main attributes to their success are the sound scientific knowledge and methods on which they have been built.

The types of water harvesting are different depending on the physio-topography and rainfall pattern of the region and the extent of rainfall. However, many of these traditional practices were abandoned during and after the colonial rule. India also has high levels of ground water, which have supplemented the surface waters especially during lean season as well as in regions which are rainfed. The types of systems and water harvesting practices in the different parts of India have been explained in a lucid manner in the Fourth Citizens' Report "*The Dying Wisdom*" of the Centre for Science and Environment, New Delhi. The storage of even the scanty rainfall, through simple as well as extensive types of traditional water harvesting of surface and ground water have been the important sources of water in arid regions such as Rajasthan and Gujarat. These include surface water systems such as the lakes, *talabs*, *nadis*, canals and groundwater systems such as wells, *Kunds* or *Kundis*, *baoris*, and *johads*. These water systems are briefly explained in Box 1. These practices have often saved the drought-affected regions from problems of water famine. The serious problems of water shortages in many parts of the country, particularly during this year's drought, are being largely attributed to the discontinued use of traditional water harvesting practices.

The programmes of the Government such as the DDP, DPAP and the integrated watershed projects have an element for harvesting the traditional water system and involvement of the local communities in the maintenance.

Success Stories of Use of Traditional Water Harvesting Systems

In the sandier tracts of the Thar Desert, the villagers have evolved an ingenious system of rain water harvesting known as *Kunds/tankas*, the local name given to a covered under ground tank was developed primarily for tackling problem of drinking water. These are either owned by communities or privately. Village ponds (*nadis*), *Kundis* and *tankas* in Rajasthan and *viridis* in Gujarat were common for meeting the drinking water needs of the inhabitants. In Southern India tanks and their catchments had religious importance and were not polluted. The Report on "Dying Wisdom" of CSE, 1997 have documented in great detail traditional water harvesting systems in the country., which are summarised in Box. 6.13.

6.8.4.3 Conservation of Forage Resources

The pastoralist (nomadic cattle rearers/breeders), based on their centuries of experience, developed a unique method of water harvesting for the most effective utilisation of their grazing lands and also for ensuring their revival and growth during the successive years. With the commencement of rains, the population was divided into different caste groups and dispersed to their *tobas* (small dug out ponds) along with their livestock. The *tobas* were situated within the confines of the village boundaries but outside the settlement proper. If water in one *toba* was exhausted its users were not allowed to come back to the village but had to make use of another *toba* where water and fodder might still be available, and by convention they had to be allowed the facility of using the water and grazing resources there. It was only when the water in all the *tobas*

Box. 6.13 Traditional Water Harvesting Systems

A. Types of Surface Water Systems

Nadis: *Nadis* are village ponds used for storing water from an adjoining natural catchment during the rainy season. A *nadi* is essentially a natural surface depression. Some have stone walls built for extra storage and for water retention. Most villages in Rajasthan have their own *nadi* and the site of *nadi* is selected by the villagers based on the available natural catchment and its water yield potential. Water availability from a *nadi* would range from two months to a year after the rains. The location of a *nadi* had a strong bearing on its storage capacity due to the related catchment and runoff characteristics. *Nadis* were heavily relied on for human and livestock needs. A survey done by the Centre for Science and Environment found that the drought affected districts of Nagaur, Baramer, and Jaisalmer were found to have 1436, 592, and 1822 *nadis* respectively. They meet 37% of the water needs. The Jodhpur town has about 25 *nadis* in and around it. However, the water is not very suitable for human consumption but are important source of water for livestock and for irrigation and for recharge of wells.

Talabs: *Talabs* are ponds and are water reservoirs situated in valleys and natural depressions.

Tanks: In other districts of Rajasthan, tanks stored water during the monsoon, for drinking purpose. Tanks are in *situ* structures with massive masonry walls on four sides and floor. They are either square or rectangular and have an enormous water holding capacity. Tanks were provided with an efficient system of canals to bring rainwater from the catchment areas in the outskirts of the town or city.

Lakes: Very deep depressions of talabs form lakes. The Padmasar and Ranisar lakes in Rajasthan are good examples of lakes, which even today are important sources of drinking water. Overflow from *talabs* and lakes, especially during the monsoons, help in the recharge of wells and *baoris*. Earlier these could support a large township round the year and a major part of the year. But with increasing destruction of the catchment area, and poor state of canals, these lakes are not getting adequate water.

Khadin: Khadins consist of earthen embankments to capture and conserve the surface runoffs in agricultural fields. The local people grow natural vegetation upstream Khadins, which binds the earth and checks wind erosion.

Canals: Canal systems consist of numerous water courses, channels and aqueducts to carry rainwater to the city's various tanks, nadis and talabs.

Johads: *Johads* are water collection barriers and are essentially embankments to arrest rainwater during the monsoon. The *Johad* bed is subsequently used to cultivate crops.

B Groundwater Systems

Kunds or Kundis (circular pits with dome like covering) have long been used as storage reservoirs in the water scarce districts of Barmer, Nagaur, Bikaner, Chru districts in Rajasthan.

Wells: Wells are deep underground pits lined by cemented masonry. This is the most common system of harvesting of groundwater.

Baoris: *Baoris* are community step wells. Shallower than wells, they have the capacity to hold water to almost its full capacity as the system lets very little evaporation. The *baoris* in Jodhpur district have been an important source of drinking water.

Source: Report of the Fourth Citizens Report – “The Dying Wisdom” of the Centre for Science and Environment.

Box 6.14 NGO-People’s Participation in Revival of Traditional Water Harvesting Systems

A NGO Tarun Bharat Sangh in Alwar, Rajasthan has successfully revived a dry river by constructing a series of checkdams by involving villagers of the area. The villagers have now formed what is called a ‘river parliament’, which meets regularly to discuss its management. Villagers of Sayla Taluka, Surendranagar district in Gujarat themselves, under *van-talavalli* (forest ponds) scheme, dug up 10 such small ponds, each with a capacity of 500,000 gallons of water, recharging the water table in the adjoining areas making that much more water available for irrigation. They have switched from Pearl millet (*Bajra*) to wheat. Other NGOs such as Anna Sahab Hazare in Ralegaon Siddhi, Maharashtra (Ganesh and Vasudha Pangre 1992), Sadguru Water and Land Development Foundation and Agha Khan Rural Support Programme in Gujarat, to mention a few, have done outstanding work in the area of water harvesting using traditional knowledge with community involvement.

Source: Centre for Science and Environment, 2000

was exhausted that the entire population, along with their stock, returned to the village proper and were allowed to use the water in the village tank and the lush growth of grasses around the village. Severe penalties were imposed on graziers for violation of regulations designed to control grazing and water use from *tobas* (Malhotra 1988). The *Jagirdar* (feudal landlord) imposed animal grazing tax (*ghas-mari*) and periodic free gifts (*laag*) especially from owners of large flocks of sheep and goat, which acted as a strong deterrent against indiscriminate grazing (Jodha 1978). With the abolition of *Jagirdari*, the practice of realising grazing tax was discontinued resulting in free ranging and consequent degradation of rangelands.

6.8.4.4 Combined Production System

The practice of agroforestry *viz.*, cultivation in spaces between trees and shrubs, has been traditionally practised by the desert dwellers. For example, *Prosopis cineraria* in cultivated fields and *Ziziphus mauritiana* in rangelands are common in arid and semi-arid parts of Rajasthan. The communities have a strong belief that trees and shrubs not only provide fodder for livestock but also increase crop growth under their canopy. And, as cultivation of crops alone is a big gamble in arid areas, most desert dwellers follow mixed farming to minimise risk against total crop failure, in which animal husbandry is an important component. Density of *P. cineraria* varies from 20 to 40 trees per ha in cultivated field of flat alluvial plains having deep (100-150 cm) sandy loam to sandy clay loam soils underlain by *kankar* pan in 350-450 mm rainfall in Shekavati region of Rajasthan (Shankar 1980). In dryland regions planting of trees along field boundaries, roads and around homesteads and watering points for shade is a common traditional practice.

6.8.4.5 Protection of Vegetative Cover- Sacred Groves

There are several sacred tree groves dedicated to temples spread over the entire country. Communities zealously protect these groves against interference of any kind. These groves are excellent examples of biodiversity conservation. For example, it was religiously prohibited to cut any vegetation from the lands in the immediate vicinity of temples and religious places, known as *Oran* (protected forest) lands. Collection of dry wood only was allowed for fuel and serious punishment was prescribed for using an axe in *Orans*. In Barmer, Jaisalmer, Nagaur, Jodhpur, Pali, Sikar, Jhunjhunu, and Jalore districts of Rajasthan there are still 420 *Orans* covering a total area of 100,140 ha (Govil and Daima 2000). Some customs observed by the *Bishnoi* community in Rajasthan and Haryana helped to conserve vegetation and wild animals. An incident that occurred over 250 years ago in Khejadala village in Jodhpur district in Rajasthan is a dramatic example, in which *Bishnoi* women zealously sacrificed their lives by hugging their *Prosopis cineraria* (*khejri*) trees rather than allowing these to be cut down (Malhotra 1986). There can be little doubt that these strategies emanated from people who had a strong concern for preservation of their environment and its ecosystems, an attitude which enabled societies to conserve their resources through “oral fencing”.

6.8.4.6 Water Utilisation Practices

A useful indigenous technique of water conservation called pitcher planting. Earthen pitchers with holes on one side are embedded near the root zone of newly planted seedlings to provide it with the required amount of water. This technique prevents loss of water either due to evaporation or seepage and helps in seedling establishment. This technique is still practiced by melon cultivators in arid region of Rajasthan. Similarly, these farmers bury bushes in a chess board pattern (similar to stubble mulch) to protect melon plants from getting buried by shifting sands. These techniques have been successfully adopted in arid zone afforestation in the country and else where (Kaul 1970). Dryland farmers raised windbreaks (*matl*) around their fields and

homesteads to protect crops and their livestock against hot desiccating winds.

6.8.4.7 Energy

Lopping of trees such as *Prosopis cineraria*, *Azadirachta indica* and *Ailanthus excelsa* during winter season for leaf fodder is still a common traditional practice in arid and semi-arid regions of Rajasthan. The branches and twigs are used as firewood. The practice of lopping trees during winter season has been found scientifically sound, as it causes no damage to trees for they are dormant and by then all the food is translocated to roots (Bhimaya, *et al* 1964).

6.8.4.8 Storage of Grains/Tubers

In some parts of the country tightly woven rope baskets are used to protect rice against rats for up to five years, unlike the plastic bags that are now used in many areas. The farmers of Malwa region of Madhya Pradesh have been successfully storing potato crops in dug out pits lined with bricks from times immemorial. Following this technology, potato crop can be stored for a period of at least four months and their carbohydrate content has been found to be less than the ones stored in cold storage. This technology is reported to have aroused world wide interest.

Conclusion – Need for Suitable Integration of Traditional with Modern Technologies

Technology is not neutral. Political and economic forces both drive it at the macro and micro level of development planning. Most development projects have involved the injection of technologies from outside the community. Rarely have development projects relied on indigenous technologies and on traditional knowledge of the people. Technology choice has usually been influenced by external factors such as national and state government policies and the policies of external donor agencies. Village ecosystem planning should try to integrate the best in traditional knowledge with the best in modern science and technology. India is a country where people have lived for thousands of years and have carefully observed their environment to develop their survival systems. As a result, traditional technologies and practices are usually rooted in ecological wisdom and the social traditions of local communities. Modern technologies, however, aim to increase productivity, usually through an intensive use of external inputs. For this reason, modern technologies are often very capital intensive and demand new skills that are often missing in the villages, and thus tend more to mystify than enlighten. More over, the high productivity wrought by modern technology can be sustained only if it is based on production systems that are ecologically sound. There is, therefore, a need to integrate the best elements of modern and traditional technologies in areas like landuse, agroforestry, water conservation, etc. Some of the traditional technologies discussed here offer promising entry points for developing packages on community-based dryland resource management technologies. While these changes in the strategy would result in better implementation of these programmes, the participation of local communities may also lead to greater use of traditional practices. It is, therefore, necessary to document such knowledge base through a properly designed research programme and to analyse their economic, technological and socio-cultural sustainability for optimisation of their use. Such a programme would be initiated in cooperation with non-governmental organisations (NGOs) within the NAP framework.

6.8.5 Technologies to Mitigate the Effects of Drought⁵

6.8.5.1 Measures to Combat Land Degradation Caused Due to Drought

From the relationship explained above, it is obvious that to control drought driven land degradation, it is

essential to moderate if not totally control the droughts. The specific management strategies to tackle droughts depend on their type and intensity. For example, deficit of rainfall during the onset, progress and withdrawal of monsoons can cause early, mid and late seasonal droughts. Measures to tackle early season droughts include transplantation and changing the crop and varieties, whereas mid season droughts can be controlled through reducing the leaf area by regulating the plant population or management strategies like mulching and keeping the field weed free. *In situ* water conservation and water harvesting and recycling as supplemental irrigation obviously can mitigate drought to a great extent but need more efforts and inputs. However, there are very few options to manage terminal droughts due to early withdrawal of monsoon. Harvesting the crop for fodder (if so such value) is the only way to slightly reduce the damage. Nevertheless, most of the drought management strategies need to be adopted from the beginning of the season in order to be effective. In other words, “one has to provide for drought management, before planting the crops even if the forecast is for a good year”. Therefore, the farmers sow a mixture of crops and thin out the cropstand as the intensity and duration of rainfall becomes clearer over the passage of time.

6.8.5.2 Use of Early Warning Systems

Long-term weather data can be used for forecasting of the rainfall and behaviour of monsoons. While long term forecasts are still not possible for various limitations in the data sets and the complexity of parameters involved in the behaviour of monsoons, short range (48h) and medium range (3-7 days) forecasts of the likely aberrations of the spatial and temporal distribution of rainfall are now possible. However, an effective and timely information delivery system needs to be developed and put in place for the forecasts to be effective for the farmers across the country. The efforts of the IMD and the National Centre for Medium Range Weather Forecasting to provide agromet advisory services to the farmers are relevant in this context.

6.8.5.3 Agriculture Based Technologies

(i) Crop-weather modelling

With the availability of high speed computers in seventies it has become possible to include large number of variables and data sets from many years and locations in order to predict the behaviour of the rainfall and temperatures for a particular location. Currently, these models are being used to predict the weather at the national and regional levels. However, if the output from the models are to be useful to the farmers in day to day crop planning, they need to be translated into agromet advisories at the district and sub-divisional (Mandal, Taluka) level as an effective information delivery system so that the advice reaches to the farmer timely. Of late, GIS (Geographical Information System) has become an integral part of the data base management and it can interlink various data bases in the RDBMS for getting query based outputs. Once the effective usable agromet data base is established which covers not only weather data but also the soil and crop growth information, effective models can be developed using GIS which may be made relevant for specific targeted areas. Such models not only can assess the drought intensity and its occurrence over a given location but also can predict the dynamics of pests and diseases which adversely affect biomass production and crop yield.

(ii) Contingent crop planning

Aided with the output from the weather forecasts, an effective land use planning strategy should comprise

⁵ Singh, et.al. 2000-Report of WG#2- Sustainable Agricultural Practices.

the use of this valuable information into specific contingent plans for different areas in order to moderate the effects of drought and minimise the land degradation. Based on the network experiments in the All India Coordinated Research Project for Dryland Agriculture (AICRPDA), a number of contingent planning strategies have been evolved to tackle early season droughts and moderate mid season drought effects (Table 6.24). However, the success of these strategies would depend once again on putting in place an effective input delivery system which responds to minimum lag time, and also establishment of seed and fodder banks etc.

Table 6.24 Promising treatments for mitigation of early and late season droughts.

Location	Crop	Treatments	
		Early season drought	Delayed seeding
Bangalore	Finger millet	Kaolin spray (5%)	Increased seed+fertilizer
		CaC ₁ spray (2%)	Transplanting
		Defoliation	
Agra	Pearl millet	Straw mulch (5 t ha ⁻¹)	Increase seed and fertilizer
		Soil mulch	Transplanting with increased population
		Kaolin spray Urea spray	
Rewa	Paddy	—	Transplanting
Bijapur	Pearl millet	Removal of weaklings+ straw mulching+ anti-transparent spray+ urea spray	—
Rajkot	Groundnut	Straw mulch @ 5 t ha ⁻¹ Earthing up	—
Anantapur	Groundnut	Application of sand @ 40 t/ha during stress period	—
	Sunflower	Mulching with groundnut shells @ 5 t ha ⁻¹ together with one supplemental irrigation	—
Solapur	Pearl millet	Formation of ridges and furrows before seeding for both early and terminal season drought	—
Phulbani	Upland rice	Deep seeding (5-7 cm) with the application of FYM and fertilizer in lines	—
Ranchi	Upland rice	Application of 5 cm depth of water on minimal irrigation (or) straw mulch	Higher seed rate
Indore	Soyabean-chickpea	—	Application of safflower stover @ 2 t ha ⁻¹
Bhawaniapatna	Upland rice	Mulching with local weeds/farm waste from germination onwards	—
Dantiwada	Pearl millet	Calcium chloride spray (5%)	—

Source : Compiled from Annual Reports of AICRPDA Centres.

(iii) Mid-season correction

Even in a timely sown crop, long dry spells during the growing season can cause significant drop in yields. Since such drought spells occur during a standing crop, the farmer has limited options to prevent the negative effect. However, certain specific corrective measures can be taken to minimise the effect of mid-season drought. Such droughts usually occur when the crop is 40-50 days old with maximum leaf area which results in fast depletion of soil moisture. Therefore, reduction of leaf area either by rationing or thinning can mitigate the drought effects to some extent. Weed control and mulching are other short-term measures which can mitigate drought by conserving the scarce moisture. In case of long duration crops like castor, pigeon pea and sorghum, @ 2% urea spray is useful after a good rain wets the foliage and the plant starts recouping. Long term measures for improving the soil moisture storage through appropriate land configurations also contribute to minimise the mid-season drought effect. However, these measures are to be planned well in advance at least in areas vulnerable to recurring droughts, as stated earlier. In short the main strategy of mid-season correction revolves around extending the moisture availability period in the soil.

Chapter 7

New Initiatives

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Chapter 7

New Initiatives for Combating Desertification

Highlights of Chapter 7

The chapter explains a number of new initiatives have been taken particularly during the last decade or so for the sustainable development of the country and for addressing the problems of desertification from various angles. These include - conservation and eco-restoration, community-based programmes, integrated watershed approach, decentralisation of governance, participatory approach towards implementation of programmes and preparation of long-term integrated programmes for meeting the food-fuel-fodder and water requirements of the country.

7.1 SHIFT FROM SECTORAL TO INTEGRATED WATERSHED APPROACH

7.1.1 Integrated Watershed Programmes

The sector-based programmes formulated during the seventies and eighties, although benefited the affected areas, it was felt deficient in achieving the objectives. Also, a sharp and clear focus on achieving drought-proofing and combating desertification was not properly enunciated. As a result the direction of the programme got diluted depending upon various factors such as the perception of the State governments, capabilities of sectoral departments and pressures exerted by different interest groups. In the process, each activity under the Programme was implemented in an isolated and segmented manner and watershed unit of area development was not duly respected. The Government therefore, decided to integrate and co-ordinate all programmes related with land, water conservation and development of degraded lands based on a watershed basis. Since watershed is a geohydrologically delineated natural unit that is drained by a water system, its adoption as the basis for soil and water conservation includes biophysical, socio-economic, and sometimes political interventions for the planning, management and execution of schemes for conservation of natural resources at the micro-level.

Box 7.1 Essentials of Watershed Management

- Integration of land, water and natural resources and development of degraded lands.
- Community driven projects and schemes.
- Agencies - local communities, NGOs, VAs, and development departments/agencies also involved in planning, development, execution of programmes including awareness raising.

A Technical Committee chaired by Professor. Hanumantha Rao, former Member, Planning Commission has, therefore in 1994, recommended revamping of the strategy for the implementation of these Programmes (MORD,1994). The Committee's recommendations of fully involving beneficiaries in the watershed development planning as well as implementation of the works through the Watershed Development Teams and sanctioning of works on the basis of the action plans prepared on watershed basis were made mandatory instead of a fixed amount being allocated per block. The recommendations of the Hanumantha Rao Committee led to the preparation of "Common Guidelines for Watershed Development" (also known as "Common Guidelines"), which became effective from 1.4.1995 (Box 7.2). The three watershed schemes of the MORD,

viz.- DDP, DPAP and IWDP and the Employment Assurance Scheme (EAS) are being implemented in accordance with the provisions of the Common Guidelines using the watershed approach and ensuring people's participation.

Box7.2 Elements of "Common Guidelines for Watershed Development-1995

- Focus of village common land
- Institutionalisation of community participation.
- An emphasis on enabling the creation of sustainable rural livelihood support systems.
- Recognition of capacity-building measures as a vital component of the watershed project design.
- Institution of Committee systems at the State and District levels.
- Decentralisation of the processes of planning and bringing user-communities to centre-stage.
- Securing the participation of women and the landless poor.
- Putting in place arrangements that facilitate equitable sharing of the usufruct.

A Committee headed by Shri Mohan Dharia, former Member, Planning Commission was also constituted in 1994 on Wastelands Development also made valuable suggestions for restructuring of watershed projects (Box. 7.3.)

Box 7.3 Recommendations of the Mohan Dharia Committee

- All area development programmes of the MORD - IWDP, DDP and DPAP dealt with under one Department.
- States requested to prepare 10-15 years Perspective Plans for proper water and land use and for wastelands development.
- Common Guidelines modified to provide for one-third of the Watershed Committees to be represented by women.
- Pilot projects for reclamation of saline and waterlogged areas of Punjab, Haryana and Rajasthan.
- Creation of a Watershed Development Fund.

Presently, at the national level, a number of ministries and departments are engaged in implementation of programmes and schemes using the watershed approach - the main ones being MOA, MORD and MOEF. Under the MOA, three main schemes namely; the NWDPR, the Watershed Development Project for Shifting Cultivation Areas (WDPSCA) in the north-eastern region and soil conservation in the catchments of River Valley projects and Flood Prone Rivers (RVP and FPRs) are being implemented. Under the Ministry of Rural Development, four schemes namely; the DDP, DPAP, Integrated Wastelands Development Project (IWDP) and the Employment Assurance Scheme (EAS) are under implementation. One scheme of the MOEF, namely the Integrated Afforestation and Ecodevelopment Project Scheme (IAEPs) is on the watershed basis. These 7 projects/programmes account for nearly 75% of the funds and areas being covered for watershed development in the country.

The restructured NWDPPRA using the integrated approach has the following important elements:

Box 7.4 Restructuring of NWDPPRA has the following important elements:	
<ul style="list-style-type: none"> • Much greater degree of flexibility in choice of technology. • Allows for decentralisation in formulation and approval of model projects. • Greater thrust on research support, innovative activities. • Transfer of technologies. • Improved institutional arrangements for capacity building and community organisation. • Better linkages with institutions including credit institutions. • Efficient management of common property resources with people's participation, etc. 	

Similar initiatives are being taken to implement the RVP and FPRs and the WDPSCA schemes. The planned coverage of rainfed areas to be treated under the three major centrally sponsored projects/programmes dealt with by the Ministry of Agriculture during the 9th Plan I and that which was realised as on 1.4.2001 is given in Table 7.1.

Table 7.1 Watershed Schemes by the Ministry of Agriculture as on 1.4.2001

S.N	Name of Scheme	Physical Target (in lakhs ha)	Resource Allocation (in Rs. Crores)	Actuals (in lakhs ha) (as on 1.4.2001)	Actual Expenditure (in Rs.Crores)
1	NWDPPRA	22.50	1020.00	22.15	722.86
2	RVP/FPR	8.70	600.00	9.81	462.19
3.	WDPSCA	1.05	75.00	1.42	66.43
	TOTAL	43.75	3556.21	33.38	1251.48

In addition, the Indian Council for Agricultural Research is actively involved in soil and water management and conservation programmes. The Division of Natural Resources Management is operating through 9 Institutes, 2 National Research Centres, 2 Project Directorates and 15 All India Coordinated Research Centres and some other Plan schemes. The NRM Division broadly categorises and implements its activities in the following 5 programmes:

- Resource Inventory
- Soil Management
- Nutrient Management
- Water Management
- Cropping System Research

Research on all these programmes are being carried out for the sustainable development of our natural resources with emphasis on protection of the environment. Technologies are also being demonstrated in model watersheds through participatory approach. The Ninth Plan allocation of the NRM Division of the ICAR is Rs. 281.99 crores.

Box. 7.5 Integrated Wasteland Development Programme in Jhabua, Madhya Pradesh

Population pressures in the area led to the reduction of land productivity and deterioration of pasture and forest lands. As a result, some people had to emigrate to search for employment in other localities. The degraded watershed lands included wastelands, community and private lands totalling 2800 hectares. With full participation of the local population of 6 villages, an integrated soil and water conservation plan was adopted at the watershed level. As a consequence, the following results were achieved:

- The area was rehabilitated as pasture and forest land.
- Previous shortages and purchases of livestock feed were done away with.
- Availability of water as a result of construction of check dams and rainwater harvesting.
- Increase in the income of the local population and decrease in migration from the region.

Watershed Projects of the Department of Land Resources, Ministry of Rural Development

The Department of Land Resources addresses the task of developing wastelands and degraded lands aimed at checking land degradation, putting such lands into productive use and increasing the availability of biomass specially fuel wood and fodder through the three major programmes, namely the Integrated Wastelands Development Programme (IWDP), the Desert Development Programme (DDP) and the Drought Prone Areas Programme (DPAP) (Table 7.2). The major activities under watershed projects under IWDP, DDP and DPAP include soil and moisture conservation measures, plantation, agro-forestry, horticulture, etc.

Since 1.4.1995, a total of 192 watershed projects under IWDP to develop an area of 18.21 lakh hectares and 8335 projects under DPAP to develop an area of 41.68 lakh hectares and 3694 projects under DDP to develop an area of 18.47 lakh hectares have been sanctioned and are under implementation as on 31.3.2000. In addition 106 projects under IWDP to develop an area of 11.03 lakh hectares, 3371 projects under DPAP to develop an area of 16.85 lakh hectares and 1659 projects under DDP to develop an area of 8.29 lakh hectares have been sanctioned during 2000-2001. So far (upto 31st March 2001), a sum of Rs. 677.45 crores under DPAP, Rs. 536.16 crores under DDP and Rs. 430.51 crores under IWDP has been released for implementation of this scheme (table 7.3).

Table 7.2: Coverage of Watershed Schemes of the Ministry of Rural Development

Programme	States Covered
Integrated Wastelands Development Programme (IWDP)	Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Haryana, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Manipur, Madhya Pradesh, Mizoram, Nagaland, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, and West Bengal, Chattisgarh, Jharkhand, Uttaranchal
Drought Prone Areas Programme (DPAP)	Andhra Pradesh, Bihar, Jharkhand, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Chattisgarh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttaranchal and West Bengal
Desert Development Programme (DDP)	Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, and Rajasthan

The Resource Allocation of the MORD for Watershed Programmes is given in Table 7.3:

Table 7.3: Watershed Schemes by the Ministry of Rural Development (1995-96 to 2000-2001)

S.N	Name of Scheme	Physical Target (in lakhs ha)	Resource Allocation (in Rs. Crores)	Actuals (in lakh ha)	Actual Funds Released (in Rs. Crore)
1	DDP	26.76	1070.40	11.74	536.16
2	DPAP	58.69	2374.60	30.80	677.45
3.	IWDP	29.24	1169.60	7.93	430.51
	TOTAL	114.69	4587.60	50.47	1644.12

The Eswaran Committee emphasised the need for embarking upon a nation-wide and massive HRD programme for functionaries at different levels involved in implementation of projects. Accordingly, guidelines were issued to provide financial assistance to State Institutes of Rural Development (SIRDs), Extension Training Centres (ETCs), and other training institutions identified by State Governments for imparting training on Watershed management. A National Committee for Watershed Training (NCWT) has also been constituted under the chairmanship of Director-General, National Institute of Rural Development (NIRD) with a view to strengthening capacity building and for implementation of time-bound watershed programmes.

7.1.2 Common Approach for Watershed Programmes

With a view to unifying and simplifying the implementation of Watershed Development programmes as a single national initiative, an Inter-Ministerial Committee was constituted in 1999 for formulation of Common approach for watershed development. The mandate of the Inter-Ministerial Committee was to examine the existing guidelines of watershed development projects and programmes of the MOA and the MORD with a view to identify the Areas of convergence and commonalities in approach in respect of specific criteria for selection of rainfed areas for treatment, programme component/interventions, institutional framework and modalities of implementation.

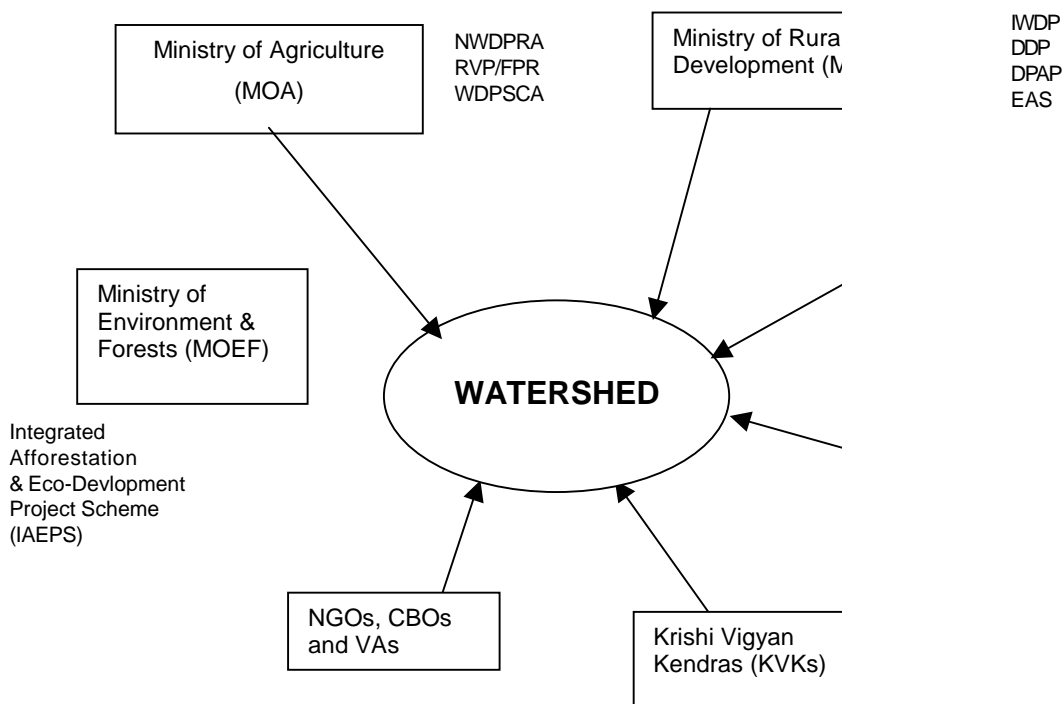
In 2000, a “Common Approach for Watershed Development” was jointly formulated and adopted by MOA and MORD, GOI incorporating the strength of the earlier first generation –based watershed programmes (MOA, 2000). The Common Approach for Watershed Development Projects is now accepted by the Planning Commission. Based on the common approach, the MOA has restructured NWDPPRA providing for decentralisation of procedures, flexibility in choice of technology and provision for active involvement of the watershed community in planning, implementation and evaluation of the programme so that it becomes sustainable (MOA, 2000).

7.1.3 Establishment of Watershed Development Fund (WDF)

Realising the effectiveness of watershed approach adopted for controlling land degradation and increasing productivity (see sections 3.2(i) and 5.2), the Union Finance Minister in his budget (1999-2000) speech announced creation of a **Watershed Development Fund (WDF)**. WDF has since been established at the National Agriculture Bank for Rural Development (NABARD) with the objective of spreading the message of participatory watershed development.

The Fund will be utilised to create the necessary framework conditions to replicate and consolidate the isolated successful initiatives under different programmes in the government, semi-government and NGO sectors (MORD, 2000). The total corpus of the Watershed Development Fund (WDF) is proposed at Rs. 2 billion. WDF envisages coverage of 100 districts in three years. The choice of district may be determined in consultation with the concerned State Government Departments. The districts and blocks selected should be predominantly backward, with significant proportion of the SC/ST population, having irrigation percentage preferably less than 30 percent (national average) and where the potential of watershed development is large. During 1999-2000, the States of Orissa, Andhra Pradesh, Madhya Pradesh, Gujarat, Maharashtra and Uttar Pradesh will be focused upon. Expenditure on field activities will not be less than 77.5 percent of the project cost.

Fig 7.1 Integration of Projects and Schemes of Various Organisations using the Watershed Approach



- Integration of various ministries' programmes from sectoral to integrated approach.
- Common Approach by the three Ministries.
- Greater role for local self governments.
- Involvement of NGOs, VAs, etc.
- Funding of schemes by 3 ministries.

7.1.4 Vision 2025 Perspective Plan for Integrated Watershed Programme

A 25-Year Perspective Plan has been prepared to cover an estimated area of 63 million hectare that would be treated under various watershed development projects/programmes involving an overall investment of Rs. 76, 000 crores. These include the watershed development projects of the Central Ministries (Agriculture, Rural Development and Environment & Forests). Out of this, an area of 10 million hectare is being covered

during the 9th Five-Year Plan. A vision 2020 for the RVP & FPRs and the WDPSCA have also been drawn to cover an estimated area of 10 mha (Table 7.4).

Table 7.4: Perspective Vision 2025 Plan for Watershed Development of Rainfed Areas

Plan	Year	Area proposed to be covered (mha)	Cost/ha (Rs in 000)	Total Cost (Rs. in crores)
9 th Plan	1997-2002	10	5	5,000
10 th Plan	2002-2007	12	7.5	9,000
11 th Plan	2007-2012	15	11	16,500
12 th Plan	2012-2017	15	15	22,500
13 th Plan	2017-2022	11.40	20	22,800
TOTAL		63.4		75,800

7.1.5 Use of Indicators for Evaluation of Watershed Programmes

The Ministry of Agriculture has integrated a set important impact and implementation indicators for evaluation of their watershed schemes. These are presented in Table 7.5.

Table 7.5: Use of Impact and Implementation Indicators in Watershed Projects of the Ministry of Agriculture.

PROJECT	EVALUATION STUDY	INDICATORS USED
National Watershed Development Project for Rainfed Areas (NWDPR)	Conducted by 10 Agro Economic Research Centres of the Directorate	<ul style="list-style-type: none"> * Increase in cropping intensity and change in existing cropping of Economics and Statistics pattern. * Increase in underground recharge as a result of conservation measures. * Reduction in soil and run-off losses with lesser siltation effect. * Increase in family income through diversified farming system such as livestock development, dryland horticulture and household production activities.
Soil Conservation in the Catchments of River Valley Projects (RVPs) and Flood Prone Rivers (FPRs)	Independent Agencies such as the Administrative Staff College of India, Hyderabad, Agriculture Finance Corporation, Bombay, Centre for Management Development, Trivandrum, National Remote Sensing Agency (NRSA), Hyderabad, Institute of Economic Growth, New Delhi.	<ul style="list-style-type: none"> * Increase in Agricultural Yield, * Increase in Cropping Intensity. * Reduction in Sediment Yield. * Reduction in Peak Rate Runoff. * Groundwater Recharge.
Reclamation of Alkali Soils	Outside Agencies	<ul style="list-style-type: none"> * Net increase in sown area. * Increase in gross cropped area. * Average crop yields & crop intensity. * Additional employment.
Watershed Development Project in Shifting Cultivation Area (WDPSCA) (not in dryland region)		<ul style="list-style-type: none"> * Has been initiated in some of the watersheds.

7.1.6 Working Group set up by Planning Commission for the on-going Watershed Projects of the MOEF-MORD- MOA.

In pursuance of the recommendations of the Eswaran Committee, a National Standing Committee for Watershed Development under the Chairmanship of Deputy Chairman, Planning Commission with Ministers

in charge for Rural Development, Agriculture, Environment and Forests as Members has been constituted effective from August 9, 1999. The Committee is reviewing the progress of watershed development schemes and analyses the experience in the field with a view to make suggestions on various aspects of the programme (MORD, 2000).

A Working Group on Watershed Development, Rainfed Farming and Natural Resources Management for the 10th Five-Year Plan (2002-2007), headed by Shri J.C.Pant, former Secretary, Department of Agriculture and Cooperation, Ministry of Agriculture, has been constituted by the Planning Commission. The Group is to review the schemes of the MOEF, MOA and MORD and to suggest measures/programmes to bring about improvements in implementation and sustainable development of land and water resources with the following Terms of Reference:

- (i) To review the performance of various central and centrally sponsored schemes being implemented by the Department of Agriculture and Co-operation during the ninth Plan with reference to their goals set both in terms of physical and financial achievements and to suggest modifications so as to make these programmes more effective in realising the objectives of soil and water conservation, land reclamation and development and rainfed/dryland agriculture programmes for the sustainable development of natural resources.
- (ii) To review the performance and impact of various programmes based on watershed development approach such as the National Watershed Development Programme for Rainfed areas (NWDPR), Watershed Development Programme in Shifting Cultivation Areas (WDPSCA), watershed programmes of River Valley Projects (RVPs) and Flood Prone Rivers (RVPs), the watershed programme implemented under Drought Prone Areas Programme (DPAP), Desert Development Programme (DDP), Integrated Wastelands Development programme (IWDP), Technology Development, Extension & Training (TDET), and investment Promotional Scheme (IPS) implemented by the Ministry of Rural Development and the programme of the Ministry of Environment and Forests (MOEF) as well as the externally aided projects being undertaken in various States in raising land productivity, cropping intensity, *in situ* moisture conservation, safeguard on the measures for prevention of silt deposition in the reservoirs, biomass production and overall economic and social upgradation in the rainfed/watershed areas.
- (iii) To review the programmes of land reclamation during the Ninth Plan and suggest measures for making these cost effective and popular with private sector participation and also taking up programmes for some special problematic land/soils.
- (iv) The Working Group may also study the feasibility for the involvement of and investment by private sector in mechanised land reclamation development of problem soils wasteland at a larger scale, under common property regimes and State property regimes on a sharing basis or on a lease contract for a fixed period for production of high value crops.
- (v) Working Group may suggest measures, programmes for land resources development for the Tenth Five-Year Plan and the requirements of funds as also the area to be covered under the programme of various Ministries/ Departments as well as State Governments.

(Source: Planning Commission, 2000.)

7.2. CONSTITUTIONAL AMENDMENT FOR DECENTRALISED GOVERNANCE

The 73rd (*Panchayats*) and 74th (Municipalities) amendments of the Constitution delegating powers to the local self governments was a significant milestone in decentralisation of powers to the local community. Decentralisation is a major component of the enabling environment of the CCD process. The process of decentralisation is particularly relevant, if it involves the formation of local self-governments and transfer of certain powers and financial responsibility from the Central Government to the locally elected government through a democratic process for formation of a civil society institution. This is the fundamental basis for the process of governance and the participatory planning and management on the local scale. As per the 73rd Amendment of the Constitution, a large number of subject areas and programmes were transferred to elected local self governments for implementation. It is proposed to continue the process of further decentralisation of programmes and schemes, which got a fillip in the 8th Plan and 9th Plan, in the future Five year Plans as well.

7.3 PEOPLE'S PARTICIPATION IN CONSERVATION AND ECO-RESTORATION OF DEGRADED LANDS

As already mentioned in Chapter 6 and in the previous sections of this chapter, a number of programmes and projects of the Central Government are under implementation with people's participation or decentralised to the local communities.

Box. 7.6 Key Elements of People's Participation

- Designing the project.
- Planning the Programme.
- Implementation of the programme.
- Use of indigenous knowledge.
- Monitoring, demonstration and dissemination.
- Sharing & Replication of Project experience

People's participation has been made one of the essential elements in watershed development process through ownership of local communities, but also to empower the watershed communities to initiate activities on their own and take optimal advantage of other on-going development programmes of the Central and State governments.

7.3.1 Joint Forest Management (JFM)

After the formulation of the National Forest Policy (NFP), 1988, which highlights people's/ community participation in forest conservation, both the central and State Governments formulated the necessary rules and procedures to implement "involvement of village communities and voluntary associations" in the regeneration of degraded forest lands. Joint Forest Management (JFM) is a participatory process of bringing the forest department and the local people together in the management of forest and the degraded land resources. Variants of JFM have existed long before it was formalised by the Government. The Central Government set out the first set of rules vide, MOEF Circular dated 1st June 1990 and was formally launched in 1991.

In pursuance of the GOI Circular dated June 1, 1990, 22 State Governments have so far issued their guidelines to involve the village communities and voluntary agencies in protection and regeneration of degraded forest

areas on the basis of their taking a share of the usufructs from the forest areas that they protect and develop. As of January 2000, more than 36,075 Village Forest Protection Committees (VFPCs) are protecting about 10.25 mha of degraded forests under this arrangement (MOEF, 2000). In order to further strengthen JFM, the guidelines were further revised in February 2000 (MOEF, 2000). The revised guidelines prescribe the following:

- Register all the Forest Protection Committees as Societies under the Societies Registration Act, 1860.
- Give uniform nomenclature to such committees, viz., Joint Forest Management Committees.
- Ensure that at least 50% of the members in the JFM general body and at least 30% in the executive committee should be women.
- Bring also good forests (with crown density above 40% except the Protected Areas) under the scope of JFM. However in the first instance, implementation of JFM in good forest areas shall be done in a phased manner on a pilot basis. The activities would concentrate on non-timber forest products (NTFPs), which can be given free or on concessional rates as per existing practice in degraded forest areas under JFM.
- Felling of trees and harvesting of timber will be as per the provisions of the Working Plan.
- Provide for overlapping working circle in new working plans for incorporating broad provisions of microplans.
- Emphasise a marketing linkage for better return of NTFPs.
- Ensure that no less than 25% of the share of village community should be contributed to the Village Development Fund for long-term sustainability of resources.

Similar arrangements for people's participation in the form of "Watershed Association" have been made for implementation of DDP, DPAP schemes of the MORD and the NWDPRAs of the MOA. The Panchayati Raj Institutions (PRIs) have a pivotal role in this arrangement (MORA&E, 1998, MOA, 2000).

Box. 7.7 Forest Protection under JFM in West Bengal

The south-western part of West Bengal, comprising mainly the districts of Purulia, Bankura and Midnapur, is a lateritic tract having about 400 thousand hectares of forest area, mostly having sal forests. Over the years, the forest area had been rendered virtually unproductive on account of commercial exploitation and unregulated grazing and fuelwood collection by the people.

In 1972, the local forest staff initiated a new programme for rehabilitating about 1300 hectares of denuded sal forest at a village called Arabari in Midnapur District. The rehabilitation scheme focused on generating sustained productive employment in the forest area, so that the people did not have to pilfer firewood from the forest and sell it in the market. The project also grew fuelwood, so that the people got it at cost price, and persuaded the villagers to carry out cattle grazing on a rotational basis. People were even allowed to raise paddy on forest lands, which was sold to the same people at a cost price. Thus, the immediate requirements of the people were taken care of which paved the way for enlisting their willing cooperation in protecting the forest area and forming forest protection committees at the village level. Meanwhile the natural forest regenerated just after three years of protection. Sal coppice shoots had attained an average height of 4 metres and creepers such as *chun alu* had begun to climb sal stems. A substantial increase in ground litter was also observed. By 1994, the experiment which had started over an area of 1272 hectares had spread to 390919 hectares.

The strategy worked at Arabari was then expanded to the other adjoining areas in the past few years. The result is that at present there are 1266 Forest Protection Committees (FPCs) actively involved in managing about 152 thousand hectares of forest lands in Purulia, Bankura and Midnapur Districts, which works out to nearly 37% of the total forest area in the region. It is estimated that 75% of the forest lands under FPC are well protected, with the degraded sal forests rapidly regenerating.

Source: G.K.Kadekodi, et al. Regeneration of Degraded and Wasteland, Institute of Economic Growth, New Delhi as part of UNDP/MOEF Funded Project.

Box. 7.8 Community involvement in Social Forestry Programme in Rajasthan, Karnataka and Tamil Nadu: Some reflections

The Common Property Resources (CPRs) like village woodlots, grazing lands, tank beds, forest shores and so on play an important role in supporting not only land holding families but also the landless in meeting their basic needs such as food, fodder, fuelwood and small timber. Various afforestation programmes such as Social Forestry and Farm Forestry were introduced in different states to deal with degrading CPRs. It was also envisaged to make the social forestry programme a community based one.

In spite of some failures, the social forestry programme has been a success in few states e.g., Gujarat and Rajasthan. However, some problems do persist in ensuring people's participation in the management of CPRs in some parts of Karnataka and Tamilnadu e.g., lack of awareness on the part of people about the Social Forestry Programme. There were some operational problems also e.g., local people were not consulted in choosing plantation sites and seedlings to be raised on the proposed plantations and this resulted in conflict between officials and local people at a later stage. Also, the available grazing lands in most sample villages are not sufficient to feed the existing livestock; and this compels villagers to graze their livestock in plantation areas in the initial year of plantation resulting in destruction of saplings and frequent quarrels between the rural community and forest authorities. Above all, the wages given by Forest Department in the villages were less than prevailing agricultural wage rate.

Village Chandesara in Udaipur district, Rajasthan is an example of successful involvement of people in afforestation work. About 78% of the area was highly degraded, hilly, without any source of irrigation. About 5 years back there was acute shortage of fuelwood and fodder here. The methodology adopted was soil and water conservation measures and plantation of several species of multipurpose trees through people's participation. The proportion of various species selected is : 40% fuelwood species, 40% timber species and 20% fruit species. There is an increase in the availability of fodder grass. Fodder is obtained mainly in the form of grasses and to some extent from the lops and tops of fuelwood and timber species. This has resulted in higher milk production. The grass is distributed to all villagers for a token charge; a villager pays Rs.10 per day and cuts any amount of grass. Despite this, net income to the society from sale of grass has shown a steady increase over the years from Rs. 1559 in 1990-91 to Rs. 6035 in 1993-94. Income from sale of seedlings also show a similar trend rising from Rs. nil in 1990-91 going up to Rs. 35,000 in 1993-94. About 8 ha. Of private lands and 175 ha. Of degraded and barren community lands have been afforested under the project. Apart from its intrinsic value as a sustainable asset, it has brought about perceivable improvement in the local ecology and environment.

Source: G.K.Kadekodi, et.al. Regeneration of Degraded and Wasteland, Institute of Economic Growth, New Delhi as part of UNDP/MOEF Funded Project.

7.3.2 Eco-Development Scheme in and Around National parks and Sanctuaries including Tiger Reserves

The scheme was launched to provide alternate sources of sustenance to the communities living in the fringes of National Parks and sanctuaries including Tiger Reserves, to improve the ecological productivity of the buffer zones of protected areas through the involvement of these communities in protecting these Protected Areas (PAs), through a designed package of activities aimed at providing sustenance to the forest side communities and ameliorating their hardships to minimise conflicts between these communities and the protection staff. The various activities proposed under the scheme are: (i) Habitat improvement, (ii) Alternate sources of energy, (iii) Infrastructure buildings/roads, etc., (iv) Small welfare measures. During 1999-2000,

an amount of Rs. 217.19 lakhs was released to various States under the scheme.

7.4 INVOLVEMENT OF NGOS

NGOS form a very important interface between the government and the local people. Activities of the NGOs essentially covers the following major programmes/areas:

- Common Property resource management.
- Creating environmental awareness.
- Family planning and welfare.
- Sanitation.
- Gender equity development.
- Child welfare.
- Self-sufficiency programmes
- Alternate livelihood programmes.
- Studies on evaluation and impact of agricultural and rural development projects.

A number of such successful examples are available from different parts of the country on the involvement of NGOs in ecorestoration of degraded watershed and wastelands. These success stories indicate that problems of desertification/land degradation are continuing in such areas where the microwatershed programmes have not been implemented seriously. They are also weak where community participation has not been vigorous. Following the recent drought, NGOs and the local communities in many drought affected districts have come together for building/ reviving traditional water harvesting systems. This indicates that the local communities turn to the traditional systems whenever there is serious water famine. The ultimate success in the continuation of a measure/scheme lies in the acceptance and ownership of those activities thereunder and it is vital that the communities are involved from the beginning of the programmes.

Box. 7.9 Management through Cooperative of the Members

The National Tree Growers' Cooperative Federation (NTGCF) is an example of management of degraded land through a cooperative system. The NTGCF, in its objective to restore and protect the biological productivity of marginally productive and unproductive degraded land or wasteland for sustaining fuelwood and fodder plantation, has been organising and developing village level Tree Growers' Cooperative Society (TGCS) in the states of Andhra Pradesh, Gujarat, Karnataka, Orissa, Rajasthan and Uttar Pradesh. The NTGCF has assisted the TGCS in making available plantation materials, financial assistance, carrying out technical and socio-economic research and development activities through its spearhead teams located in the above states.

The TGCS plantation site at Mallenahally in the Kolar district of Karnataka, is now no more a wasteland because here, NTGCF has been very successfully in achieving the objective of regenerating the wastelands in the country (Reddy et al., 1997). This site covers an area of 20 hectares of land surrounded predominantly by agricultural land and few acres of social forestry land at one side. Before this land was taken up by TGCS, it was a revenue wasteland which was barren or being used for grazing purpose. The land was fully barren with about 10% of the total root stock underneath the soil cover. With the inception of TGCS plantation since 1989, there has been a lot of developments in and around this small watershed. The Mallenahally TGCS land, which was once an under utilised degraded wasteland, is now filled with different grass and plant species. The main forest plants include babul, acasia and eucalyptus. Beside, TGCS has undertaken soil conservation measures such as making contour bundings, mulching, plantation of grasses along the draining streams. This has considerably

reduced the soil loss and considerably improved the quality of the soil *in-situ*. Therefore, this micro watershed has been developed and protected from being degraded further.

The Sarnal Tree Growers' Cooperative Society (STGCS) which has been organised by the people of village Sarnal located at the left bank of river Mahi in district Kheda in Gujarat is another clear example of TGCS' efforts in regeneration of degraded wasteland (Saxena and Agarwal, 1997). The STGCS had acquired about 35 ha of revenue wasteland on lease from the Government of Gujarat in 1987 for the purpose of tree plantation. The soil of this plot is sandy loam but highly eroded. There are many gullies in the plot, some of them as deep as 30 meters. Various soil conservation measures were taken up on the land immediately after acquiring it and the land was put under tree plantation. The leased-in land was put under tree plantation by the cooperative in a phased manner as follows : 6 ha in 1987-88, 20 ha in 1988-89 and 9 ha in 1989-90. There were about 60000 trees of nineteen species on the cooperative plot as per the counting done in the year 1994-95.

NTGCF initiated Energy Conservation programmes in its project areas and in other villages through 60 milk unions across the country, in order to reduce the pressure on the common lands and thereby consolidating the afforestation efforts and help to improve the quality of life of the rural people. These programmes include installation of biogas plants, improve chullhas and the distribution of solar and pressure cookers. The fuel efficiency studies conducted by in Kolar district of Karnataka and Gujarat corroborated the fact that the improved chulhas save 30 to 40% of fuelwood as compared to the conventional types of chulhas. In a classic case of energy conservation, 90 out of 97 family biogas plants installed in the Namanar TGCS of Gujarat are functioning well for the past four years resulting in an estimated fuelwood saving of 90 Kg. per day.

Source: G.K.Kadekodi, et.al. Regeneration of Degraded and Wasteland, Institute of Economic Growth, New Delhi as part of UNDP/MOEF Funded Project.

Box. 7.10 The Sukhomajri Project

This project was launched in Ambala district of Haryana in 1979. It focused on harvesting and recycling of rainwater. The extent of people's participation is high. The total expenditure on the project was Rs. 78.32 lakhs and the average expenditure per ha of area covered was Rs. 1917. About 61% of the total cost was accounted for by skilled and unskilled labour. The project resulted in a significant increase in crop and milk yields rates and production, reduction in the number of cows and goats, increase in the number of buffaloes, increased availability of water and higher incomes.

The Sukhomajri experience shows that exhortations for participation and co-operation do not work, especially if they are aimed at people who live on the margin of subsistence. The poor cannot stop grazing their animals in highly degraded and over—grazed common pool lands for the sake of their conservation when their lives depend on their animals. Only with the availability of water - the crop yield increased, and the villagers were inspired to take up sustainable development measures and to regulate grazing in the catchment area of the river.

Source: G.K.Kadekodi, et.al. Regeneration of Degraded and Wasteland, Institute of Economic Growth, New Delhi as part of UNDP/MOEF Funded Project.

7.4.1 RIOD (Reseau International des ONG sur la Des'ertification) Network: an NGO Network created under the UNCCD for Combating Desertification

The UN Convention to Combat Desertification is one of the International Conventions which lays emphasis on people's participation, involvement of local communities and partnership building in the implementation of the Convention. NGOs and CBOs have an important role for improving the living standards of the local

population by working as an interface between the State and the local population in areas such as raising awareness, assisting in local developmental programmes and schemes, and capacity building and directly empowering the local communities in implementation of natural resource management and measures for improving their employment opportunities and livelihood.

RIOD is an international network of NGOs formed as a part of the UNCCD process and their international headquarters is in Nairobi. RIOD-network has many NGOS from different countries as members. RIOD-INDIA was formed in 1995 and its Secretariat is located in Youth for Action, Hyderabad. RIOD-INDIA is a vast network of NGOs from all States divided into 5 regions- Northern, Eastern, Western, North-eastern and Southern and has a large number of NGOs from these regions as its members. RIOD-INDIA actively participates in all the for a of the UNCCD process including the Conference of Parties. The Afro-Asia Global NGO Network on South-South and South-North cooperation for the implementation of the UNCCD was organised by RIOD-India in Hyderabad during December 9-12, 1996. RIOD INDIA is actively involved in issues such as empowerment of women, assisting in providing micro-credits for alternate employment, generating/assisting with seed money for taking up eco-regeneration programmes, promoting micro-watershed schemes, generating awareness on issue concerning desertification, etc. Two success stories of the activities of RIO-India are given below:

Box. 7.11 Food Security - Chennamma's example of becoming self-reliant

E.Venkat Ramnayya, Youth for Action, RIOD-INDIA

Chennamma, 48 of Ullemkonda village, in Mahaboobnagar District in Andhra Pradesh has experienced recurrent drought in her area. With 5 acres of dryland and no other avenues of income except to earn a living as labourer, the option available to Chennamma was to migrate elsewhere from the hostile living conditions. But with the initiative of Youth for Action, RIOD-INDIA, Chennamma and other members of the village have been involved in regeneration of the soil fertility and productivity of their land' through soil and water conservation measures such as gully checking, bunding, and construction of percolation tank and deepening of wells, which has helped her rebuild her life in her village.

Chennamma was provided loans by Sangham and with her own contribution, bought fertiliser and high yielding varieties of seeds of *Jowar*, *Castor*, *Rostar* and *Groundnut*. Her husband who was working in another place began to work in their own field. Through their efforts, the yield per acre from various crops increased by more than 50%. Yield of important crops improved.

The improvement in the yield and the income level increased in 3 years and even during lean periods. This helped her to provide her children better nutritious food; the rice eaten earlier was supplemented with *Jowar* and *groundnut*, fulfilling the basic nutritional requirement. Chennamma extended her skills to raising of species such as *Tamarind*, *Cheema*, *Chinta*, *Subabul*, *Gliricidia*, and *Acacia* in nurseries. These are especially grown in semi-arid tropics and drought resistant varieties. Through appropriate utilisation of her land, she was able to obtain fodder, fuel, biomass, timber. Chennamma started vegetable cultivation programme in her garden to grow vegetables such as tomato, brinjal, ladies finger, etc. Her physical health improved due to intake of better nutritional diet. She presently helps other women in the neighbouring villages about the skills she has acquired through her efforts of the past 3 years.

The case of Chennamma is an example of how one can attain food security and self-sustenance through simple practices of land conservation measures and provision of micro-credits.

Box. 7.12 GANDHIVAN - A Successful Attempt at Wasteland Development through Peoples' Participation

Bhawani Shankar Kusum, Gram Bharati Samiti, Distt. Jaipur, Rajasthan, RIOD-INDIA

Gandhivan is a 25 ha. wasteland which was allotted to the Gram Bharati Samiti (Society for Rural Development) by the Government of Rajasthan in 1991. The area is a very backward one in the district. At that time, the land was totally barren. There was no source of drinking water in the area. The natural resources in the area had declined. The pasturelands of villages had been encroached, forests had been chopped down. Due to decline of the environment, the cottage and small village industries of the 30 villages in the area had vanished which further deteriorated the economy of the people in the area. But today after 8 years of hard work the land has been converted to an orchard-cum- forest having more than 50,000 plants producing fruits, fodder, and fuel. Gandhivan was not merely a project for development of the wasteland but to improve the level of the quality of the life of the community of the area. The project consisted of the following activities:

(i) *Augmentation of the water resources:* The level of groundwater in the area was very low. There were numerous deep gullies on the project land not allowing the collection of rainwater. The project activities consisted of plugging the gullies and building a check dam. This enhanced the water level. A bore well was dug up and a submersible pump was fitted in it. Mud trenches were built to irrigate the plants. With these activities, the rainwater was successfully harvested for use of flora and fauna of the local area including cattle from surrounding villages.

(ii) *Raising nursery plants:* A nursery of a variety of species of fruit, fodder and fuel were raised in nurseries.

(iii) *Plantation:* In the first phase, 50,000 saplings of different species were planted. Saplings were planted on all the dunes and gullies, without changing the landscape of the area.

An important aspect of the project was that most of the activities were done by local rural women and socially deprived sections (physically handicapped and leprosy patients) of the society who had been rehabilitated there. The issues of concern were discussed with the villagers through 'Gram Sabhas'. The disappearance of the local forests and traditional knowledge of the local communities, encroachment of the common pasture land, and decline of animal husbandry were matters of shared concern. The project successfully revitalised the traditional knowledge in the field of mosaic plantation, protection of some medicinal plant species, and renewing the vigour of plants by use of organic manure. In addition, organic substitutes of pesticides were prepared with herbs, ashes and leaves of 'neem'. The survival rate of plants was very good with the application of these natural pesticides. It was agreed in the meeting of villagers that no tree from the project area would be cut down for use as fuel.

With the interventions of water harvesting and use of simple traditional practices, the survival rate of plants was high in the range of 70-80% and the growth of plants was good. The yield of fruits was very high. Soil erosion was checked as a result of re-growth of vegetation and sand dunes were stabilised. The level of groundwater was raised by 3-5 metres.

Gram Bharati Samiti believes that the 'Gandhivan' project is a successful example of people's participation in community development.

7.4.2 Participation of NGOs and the Civil Society¹ in Decision Making Process

Involvement of NGOs and members of the civil society in policy making, planning and programme implementation and review is through their membership in various committees/Task Forces set up by the

¹ CCD definition of Civil Society is "Individuals or organisations from a wide range - non-governmental, private sectors, professional associations, local organisations of economic, social and cultural nature". These play an important role in the planning, decision making and in the implementation of programmes.

Government under various programmes. Distinguished members of the civil society are also nominated to the Parliament (Rajya Sabha) to represent the people.

7.5 INTEGRATION OF ENVIRONMENTAL ISSUES INTO THE PROCESS OF ECONOMIC REFORMS AND SUSTAINABLE DEVELOPMENT

7.5.1 Agenda 21 Implementation Plan

The 8th Five-Year Plan (1992-1997) was launched in 1992, which was also the year of the United Nations Conference on Environment and Development (UNCED) also known as “the Earth Summit”. Sustainable development was accepted at the 1992 United Nations Conference on Environment and Development (UNCED) as a critical element in preserving the environment and promoting development. The UNCED had agreed on a broad agenda for sustainable development of the world in the 21st century and prepared a blue-print giving the framework of objectives, activities and costs of implementation in a document titled “Agenda 21”.

The role of the Planning Commission in the Government of India was also redefined from a highly centralised planning system towards indicative planning, with emphasis on prioritisation of goals to reduce bottlenecks, and achieving higher growth rates. The Planning commission was also to play an integrative role and help in the development of a holistic approach to the policy formulation in critical areas of development. The goal of sustainable development is reflected in the 8th Plan document, which underlines the significance of ensuring coordinated and integrated Governmental action for conserving nature and ensuring sustainable use of natural resources through a participatory process. The Plan recognised “Human Development” as the core of all developmental efforts. The priority sectors of the Plan include health, education, literacy, and basic needs, including drinking water, housing and welfare programmes for the weaker sections. The Ninth Plan (1997-2002) has continued with these policies and approach.

The Ministry of Environment and Forests (MOEF) is the nodal agency in the Government of India for implementing the Agenda 21. All the concerned ministries and departments actively participate in the deliberations of the Commission on Sustainable Development (CSD) after formulating a concerted programme and strategy of that sector in the context of sustainable development. The Government had evaluated the progress of activities on Agenda-21 on sustainable development for Rio+ 5 and an exercise is currently on in regard to progress of achievements on Rio+10.

The Ministry of Environment and Forests also evaluates various developmental projects under comprehensive Environmental Impact Assessment (EIA) framework and a scientific system of Natural Resource Accounting (NRA). The Ministry of Finance have also taken interest in incorporating the environmental issues vis-à-vis development in the context of the on-going process of economic reforms.

7.5.2 Environmental Action Programme (EAP)

The Ministry of Environment and Forests (MOEF) is the nodal agency for conducting the Environment Action Programme (EAP) exercise within the Government. MOEF constituted an EAP Implementation Committee comprising Ministries, Departments of the Government of India, Research Institutes of excellence and NGOs concerned with different sectoral issues addressed in the EAP. After incorporating inter-ministerial suggestions, the EAP document was finalised in 1993. The goals of EAP are to improve the environmental services and

to facilitate integration of environmental considerations into development programmes. People's participation at the grass-root, local and regional levels are also accepted as key issues of the action plans. The Environmental Action Programme (EAP) process adopted a decentralised system of generating information and perspectives.

7.6 NATIONAL MISSION FOR ASSESSMENT OF LAND DEGRADATION IN THE COUNTRY

Considering varying estimates of degraded lands made by various agencies, the Working Group on Soil and Water Conservation for formulation of the Ninth Five Year Plan under the Department of Agriculture & Cooperation felt the need for adoption of a common and scientific approach using remote sensed information. As a result, the National Mission for Assessment of Land Degradation in the country was mooted.

The major activities of the proposed project are:

- Mapping of soil resources at 1: 50,000 scale for the entire country.
- Mapping of land degradation at 1: 50,000 scale.
- Creation of a uniform soil and land degradation database for the country.

Background for the Mission

On the basis of the current trends in the consumption pattern, it has been estimated that the total requirement of food grains is likely to be around 245 million tonnes by year by the year 2006-2007. By considering various factors such as population growth rate, diminishing per capita of land and water resources, and increasing land degradation problems, it is estimated that India will be required to produce an additional 5-6 million tonnes of food grains annually in the 21st century. This is expected to lead to tremendous pressure on soil resources along with competitive demand for it from industrialisation and urbanisation. However, the capacity of soil to produce is limited and the limits to production are set by its inherent characteristics, agro-ecological settings, and its use and management. In this context, it was felt necessary to have a national inventory of soil resources on a scale compatible for planning various developmental activities such as optimum land use at least at district level for the whole country. Both soil mapping and soil degradation mapping are proposed to be taken up as concurrent activities. The involvement of remote sensing agencies would help generate GIS databases. Thus the programme will allow for development of "District System on Degraded Lands" using GIS to that periodic updating and monitoring of the degraded status could be simultaneously taken up. The information would not only be useful for optimum land use planning for scientific agriculture but also in reclamation and/or conservation measures of degraded lands. The maps would also be used as a benchmark of status of land resources of the country for use in different time-periods.

7.7 NATIONAL FORESTRY ACTION PROGRAMME (NFAP) - Vision 2020 Document for Afforesting one-Third of the Country's Area.

The National Forestry Action Programme (NFAP) has been prepared by the Ministry of Environment and Forests in August 1999 as a part of the programme recommended by UNCED and the CSD and the Intergovernmental Panel on Forestry (IPF) for launch of National Forest Programmes globally. The NFAP is a vision 2020 document for afforestation of one-third of the country's area over the next 20 years subject to availability of financial resources. The Plan also considers meeting fuel wood-fodder requirements of the country in a sustainable manner from the forests. The NFAP also addresses the following additional elements:

- * Protect existing forest resources.
- * Improve forest productivity.
- * Reduce total demand.
- * Strengthen policy and institutional framework.
- * Expand forest area.

The NFAP has been prepared by integrating and amalgamating 26 State Forestry Action Programmes.

Box 7.13 Action Points Identified Under NFAP	
<ul style="list-style-type: none"> - For sustainability of forests, productivity of forest plantations to be increased at least 3 to 5 cu.m ha year by promoting regeneration and enrichment plantations. - Hygiene of forests to be improved through suitable silvicultural practices. - Efforts to be made to bring one-third geographical area of the country under forest and tree cover by plantations on all categories of wastelands and agroforestry. - Protected area network to be expanded and managed for biodiversity conservation. - Plantations on non-forest wastelands to be done mostly with fuelwood species as 70% of the wood produce from forest are used as fuelwood. Species of pulpwood and other industrial wood may be encouraged in farm forestry. - Institution for people's participation in protection and development of degraded and fringe forest to be strengthened. - NWFP species to be developed and value addition may be promoted at village level. - Grazing in forests to be regulated as per carrying capacity and silviculture needs. - Infrastructure for forest inventory, research and development to be strengthened. Human resource development should also be removed. - Investment for the sustainable development of forest should be rational and in proportionate to the total production. 	
Source: NFAP, MOEF, GOI, 1999	

Summary of investment estimates for implementation of NFAP (in Rs. million) to achieve the afforestation of one-third of country's geographical area is given in Table 7.6.

Table 7.6: INVESTMENT ESTIMATES FOR AFFORESTATION UNDER NFAP

Programme Activity	Expenditure Estimate (in Rs. million)	Area to be Regenerated (in mha)
Protect Existing Resources	214372.2]	26.43
Improve Forest Productivity	412917.5]	
Reduce Total Demand	27738.5	21.80
Strengthen Policy and institutional Framework	272280.5]	
Expand Forest Area	411719.1]	
TOTAL	1,339,027.8	48.23

Thus an expenditure of Rs. 1,339,027.8 million rupees is estimated to be requiring for regeneration of forest in one-third of country's geographical area (NFAP, 1999). The State-wise break-up of the proposed afforestation area to be covered and the expenditure estimated for this is given in Table 7.9.

Table 7.7: State-wise Plan for Afforestation in 20 Years

S.N.	STATES	Rs. (in million)	Area to be afforested (in mha)
1.	Andhra Pradesh	51334.1	4.93
2.	Arunachal Pradesh	14113.6	0.15
3.	Assam	20720.4	1.10
4.	Bihar	62067.6	4.21
5.	Goa	1384.0	0.03
6.	Gujarat	23246.6	2.62
7.	Haryana	15767.3	0.87
8.	Himachal Pradesh	108514.7	0.90
9.	Jammu & Kashmir	57177.2	6.27
10.	Karnataka	113377.0	3.21
11.	Kerala	26082.9	0.26
12.	Madhya Pradesh	230289.4	7.39
13.	Maharashtra	84914.2	3.36
14.	Manipur	19436.1	1.08
15.	Meghalaya	1762.6	NA
16.	Mizoram	19220.9	0.62
17.	Nagaland	4623.5	NA
18.	Orissa	27152.3	0.44
19.	Punjab	22612.7	0.66
20.	Rajasthan	191144.5	5.14
21.	Sikkim	8423.0	0.28
22.	Tamil Nadu	27188.0	0.71
23.	Tripura	4623.5	0.08
24.	Uttar Pradesh	32208.2	3.24
25.	West Bengal	57278.8	0.61
26.	A & N Islands	7587.8	0.07
	Total of All States	1232321.2	48.23
	Central Sector	106706.6	-
	GRAND TOTAL	1339027.8	48.23

7.8 NATIONAL COMMISSION FOR INTEGRATED WATER RESOURCE DEVELOPMENT PLAN

The Ministry of Water Resources has set up a National Commission for Integrated Water Resource Development Plan both for surface and groundwater with the following objectives:

- To prepare an integrated water plan for development of water resources for drinking, irrigation, industrial, flood control and other uses.
- To suggest modalities for transfer of surplus water to water deficit basins by inter-linking of rivers for achieving the above objectives.
- To identify important on-going projects as well as new projects which should be completed on priority basis in a phased manner.
- To identify a technological and inter-disciplinary research plan for the water sector with a view to maximising benefits.
- To suggest the strategies for generation of physical and financial resources for the water sector.
- Any other related issue.

The Commission has since submitted its report. The Ministry of Water Resources has constituted an Implementation Committee for implementing the recommendations of the Commission.

Revival of Traditional Water Harvesting Systems

Following the drought of year 2000 in a number of States and particularly Rajasthan and Gujarat, a movement

has begun for the revival of traditional water harvesting systems. A number of success stories on revival of traditional water harvesting systems is being documented. A few are given below.

Box. 7.14 Role of an NGO in Revival of a River in Rajasthan through Community Efforts

The village community of Bhaonta-Kolyala in Rajasthan's Alwar district have been able to turn their once parched land, into lush green through the resurrection of a river which had almost totally dried up. This was done by creation of a series of earthen dams which harnessed the rainwater, recharging the wells and eventually the Arvari river flowing through their region. The water level has presently risen to about 15-20 foot from the surface. The river, which slowly and steadily sprang back to life, has become a perennial river. The area now stands as an oasis in the desert region of Rajasthan and has sufficient water in current drought in Rajasthan. The support for this effort came from an NGO – Tarun Bharat Sangh. To honor the success of this endeavour, the Centre for Science and Environment, which has toiled for revival of traditional water harvesting in the country, selected the village for the first Joseph C John award, which was given by the President of India on March 28, 2000.

Source: Centre for Science and Environment, New Delhi, 2000

Box 7.15 NGO Role in Management of Water in Gujarat

In the Kutch area of Gujarat, the Shree Vivekanand Research and Training Institute (VRTI) run by an NGO, is dedicated to addressing the basic problems of water management, agricultural research, health and education. But the institute's most important contribution has been in water management and desert irrigation technology. Simple innovations such as rechargeable tube wells, check dams, sub-surface dykes and percolation tanks have revitalised villages in Kutuch. Despite the cyclone, which devastated large regions in Kutch in Gujarat during 1998, the use of these simple water harvesting techniques ensured a good agricultural harvest in these areas. The NGOs are of the view that the continuity of the efforts is of paramount importance. Money is not always the main input required. The participation of the local community and the joined efforts are the main ingredients for the success of regeneration of the water sources and regeneration of degraded land in this area. In addition, the local youth and children can be involved in eco-regeneration activities, including revival and cleaning up of water harvesting systems.

Source: Frontline, March 17, 2000. "Rebuilding Kutchh"

Roof Top Harvesting in Towns and Villages

This innovative method of harvesting rainwater is becoming increasingly popular in a number of towns and cities. In Dewas, Madhya Pradesh, which was one of the drought affected States in the year 2000, 21 roof water harvesting structures were put up during the monsoon of 2000, through the initiatives of the local administration. The supply of water has been more regular since this step. The trend has caught on in other areas of the town and in the rural areas of the district. The community participation in this activity has been highly encouraging. About 1855 tube-wells were done up for recharge and similar techniques were adopted for about 4000 hand pumps in the district. As a result, all the micro and mini watershed in Dewas district are to have similar plans. Similar practices are being taken up in Delhi, following the success of a pilot project in the water-deficit Jawahar Lal University, as part of Housing Plan of new Housing Societies.

The Central Ground Water Authority (CGWA), a regulatory authority set up under the Environment (Protection) Act, 1986 regulates the boring of tube wells in the country, particularly where the level of groundwater decline

is quite severe. The Authority has begun intense awareness campaigns on use of traditional water harvesting systems and roof-top water harvesting across the country.

The Ministry of Environment and Forests has, under the Environment (Protection) Act, 1986 brought out a draft Notification S.O. 916 (E) dated October 6, 2000 for specific measures to protect and improve the quality of environment in the Himalayas¹, including specific measures for rainwater harvesting. These include:

- All buildings constructed in urban areas have a provision for roof-top rainwater harvesting.
- Institutional and commercial buildings should not draw water from existing water supply schemes which adversely affects water supply to local villages or settlements.
- In rural areas, water harvesting should be undertaken through such structures as percolation tanks and storage tanks, etc.
- Spring sanctuary development should be undertaken in the spring recharge zones to augment spring water discharge.
- Rain water collected through storm water drains should be used to clean waste disposal drains and aquifers.
- Ground water aquifer recharge structures should be constructed wherever such structures do not lead to slope instabilities.

7.9 NEW POLICIES & PROGRAMMES

7.9.1 National Policies on Agriculture, Population and Biodiversity Conservation : The Government has formulated a number of new policies and macro-level strategies and action plans for natural resource conservation and for sustainable development. These include the National Policy on Agriculture, Population, Biodiversity, the details of which are provided in Chapter 6.

7.9.2 Establishment of New Departments of Land Resources and Drinking Water in the Ministry of Rural Development : With a view to addressing all issue relating to wastelands in a concerted manner, the Department of Wasteland Development was reconstituted into the Department of Land Resources in April 1999 with additional mandates of land reforms, land administration including land legislation, Drought prone Areas programme and the Desert Development Programme, etc. The other mandates of the Department of Land Resources include ecorestoration of wastelands by involving the people, concerned Central/State level machinery and also the *Panchayati Raj* Institutions. Similarly the National Drinking Water Mission with the objectives of providing drinking water to the rural areas has been converted to a full fledged Department of Drinking Water Supply under the Ministry of Rural Development.

7.9.3 Implementation of Gender Related Policies : For making development more gender sensitive, government policies now increasingly emphasise qualitative inputs, focusing on inculcating self-confidence among women; generating awareness about their rights; and training them for economic activities and employment. Efforts to improve women's access to critical inputs and productive resources such as land,

¹ The Himalayas by and large are humid/per-humid ecosystems and do not fall within the dryland regions, except for some areas which are cold arid. However, the region face acute problems of water scarcity not because of shortage of rainfall, but due to their outflow into the valleys and into rivers.

houses and trees through joint or individual titles have been expanded to include support through credit (or small scale capital), marketing, training in skills/management and technology (MOHRD, 1988). Developing women's organisations is now accepted as an effective strategy for promoting women's empowerment.

Empowerment of women is one of the major objectives of the Ninth Plan (1997-2002). This is to ensure the creation of an enabling environment with requisite policies and programmes, legislative support, and exclusive institutional mechanisms at various levels and will provide adequate financial and human resources to achieve this objective. Empowering self-help groups (by integrating developmental projects with the core activity of self-help Groups. As a strategic thrust, a Task Force on women and children has been constituted to review existing legislation and schemes relating to women's access to national resources, gender mainstreaming and other related issues. Year 2001 has been declared as the Year for the Empowerment of Women. A number of activities have been planned in this regard.

The various programmes and schemes taken up by various Ministries and Departments of the Government of India during the Eighth and Ninth Five-Year Plans is summarised in Annex- 7.

Box 7.16 A Scheme for Science and Technology for Women

Over the last decade, special efforts have been made to demonstrate the application of science and technology in improving the life and status of women. The Department of Science and technology, Government of India has a number of developmental projects for women to bring S&T closer to their daily lives, reduce their drudgery, improve their health and environment and provide new opportunities for income generation. The Ministry of Science and Technology has a scheme focussing on women as a specific target group.

Objectives:

- To promote research, development and adaptation of technology with a view to improving the living and working Conditions and opportunities for gainful employment of women especially in rural areas.
- To increase the contribution of women to science and technology and development.

Priority Areas Identified Under the Scheme:

- Specific science and technology application programmes to solve the problems of women in different regions such as hill areas, coastal and arid zones.
- Research and development on post-harvest technology and agricultural implements used by women.
- Involvement of women in low-cost production and preservation of horticultural produce.
- Utilisation of agricultural and animal residues through such technologies which can provide opportunities for income generation.
- Preparation of skill manuals/training aids in areas of agriculture, animal husbandry.
- Association of skill manuals/training aids in areas of agriculture, animal husbandry.
- Association of women in wasteland development.
- Involvement of women in indigenous health practices and cultivation of medicinal plants.
- Research, development and demonstration programmes to minimise occupational hazards of women in agriculture and industries, etc.
- Design, fabrication and improvement of equipment, furniture and instruments used by women in different occupations.
- Identification and popularisation of technologies relating to water management, health and sanitation.
- Adaptation of innovative technologies developed in centres abroad.

- Upgradation of traditional skills for utilisation of available resource and providing means for women to enter into organised sector or for starting entrepreneurial production units.
- Training programmes in areas related to mechanical, electrical and electronic technologies for ensuring the involvement of women in modern industry.
- Studies on issues concerning women scientists.
- Development of software by voluntary agencies and the mass media to popularise science and create a scientific temper amongst women.

Source: Department of Science and Technology, Government of India, New Delhi, 1996.

7.9.4 New Initiatives in Information Dissemination and Awareness Raising

7.9.4.1 Information Dissemination:

Establishment of the National Informatics Centre (NIC): Various ministries and departments of the Government of India have established independent monitoring and evaluation systems in respect of the major schemes implemented by them. Regular progress reports are prepared and the details disseminated. During the last 5 years, the National Informatics Centre (NIC) has established computer and link facilities and the information is now available on websites which have been created for most GOI departments wherein information pertaining to various schemes, and on important issues. A comprehensive website detailing the activities of all GOI departments is given in <http://goidirectory.nic.in/>

Environmental Information System (ENVIS): The ENVIS network set up at the Ministry of Environment and Forests (MOEF) presently consists of 25 network partners. The objective of ENVIS is to serve as a repository and dissemination centre in environmental science and engineering, and to provide national environmental information service to the users, originators, processors and disseminators of environmental information at national and international level. Since 1998, it has started publishing the ENVIRO Newsletter of the MOEF on monthly basis for disseminating information to all concerned on various important policies, new rules/regulations, important notifications and other important decisions taken by the MOEF from time to time. The newsletter can be accessed through Internet at the MOEF Home Page. The ENVIS Centres collect, collate, store, retrieve and disseminate information in their respective subject areas e.g., desertification, renewable energy and environment, environmentally sound and appropriate technologies, environmental education, forestry, floral biodiversity, environmental problem of mining, control of water, air and noise pollution, *panchayati raj* and environment, etc. Table 7.8 summarise the list of ENVIS centres and their focal area of activity.

INFOTERRA Network: For the INFOTERRA Network, a global information network of the United Nations Environmental Programme (UNEP), ENVIS continues to function as a National Focal Point and a Regional Centre for countries in South Asia Sub-region. ENVIS also maintains a close liaison with various other National Information Systems like the National Institute of Science, Technology and Development Studies (NISTADS), the Birla Institute of Technology and Science (BITS), etc. in the country for exchange of environmental information.

Sustainable Development Networking Programme (SDNP): ENVIS functioning in the Ministry of Environment and Forests was designated as the National SDNP under UNDP, as a fallout of the Rio Summit.

Table 7.8: List of ENVIS Centres in the Country

S.N.	ENVIS Centres	Focal Area of Activity
1.	Central Pollution Control Board, New Delhi	Prevention and Control of Pollution
2.	Industrial Toxicological Research Centre (ITRC), Lucknow	Toxic Chemicals
3.	Development Alternatives, New Delhi	Environmentally Sound and Appropriate Technologies
4.	Centre for Environmental Studies, College of Environmental Engineering, Anna University, Chennai	Biodegradation of Wastes and Impact Assessment (EIA)
5.	Tata Energy Research Institute (TERI), N. Delhi	Renewable Energy and Environment
6.	Centre for Ecological sciences, Bangalore	Western Ghats and Biological Diversity
7.	World Wildlife Fund for Nature (WWF), New Delhi	Non -Governmental organisations, Media
8.	Environmental Planning and Coordination Organisation (EPCO), Bhopal	Environmental Management related to the State of Madhya Pradesh
9.	National Institute of Occupational Health (NIOH) Meghani Nagar, Ahmedabad	Occupational Health
10.	Central Arid Zone Research Institute (CAZRI), Jodhpur	Desertification
11.	Centre for Advanced Studies in Marine Biology Annamalai University, Parangipettai	Mangroves, Estuaries, Lagoons and Coral Reefs
12.	Centre for Environment Education Nehru Foundation for Development, Ahmedabad	Environmental Education
13.	Zoological Survey of India M Block, New Alipore, Calcutta	Faunal Bio-diversity
14.	Centre of Mining Environment Indian Schools of Mines, Dhanbad	Environmental problems of mining
15.	National Environmental Engineering Research Institute (NEERI), Nagpur	Solid Wastes including Hazardous Wastes
16.	G.B. Pant Institute of Himalayan Environment & Development, Kosi - Katarmal	Himalayan Ecology
17.	School of Planning and Architecture I.P. Estate, New Delhi	Human Settlement
18.	School of Environmental Sciences, Jawahar Lal Nehru University, New Delhi	Biogeochemistry and Environmental Law
19.	Botanical Survey of India, Calcutta	Floral Bio-diversity
20.	Environmental Protection Training and Research Institute, Hyderabad	Eastern Ghats
21.	Bombay Natural History Society (BNHS) Mumbai	Avian Ecology including Inland Wetlands
22.	Indian Council of Forestry Research Education (ICFRE), Dehradun	Forestry
23.	Wildlife Institute of India, Dehradun	Wildlife & Protected Area Management
24.	Indian Environmental Society, Delhi	Panchayati Raj & Environment
25.	Centre for Media Studies Opp. J.N.U., New Delhi	Communication & Electronic Media

Source: MOEF Annual Report, 1999-2000

The SDNP secretariat was set up in 1998. The programme is jointly funded by UNDP and IDRC along with the GOI. The MOEF is the executing agency. SDNP acts as a clearinghouse of information on sustainable development by involving government, academic, business and NGOs. It provides information on a vast variety of thematic areas ranging from agriculture, social forestry, desertification, biodiversity, marine ecosystems, water resources, clean technologies, environment education to population, human rights, WTO, etc. In all about 30 areas have been covered. It also aims to strengthen selected ENVIS Centres and to identify new modes for disseminating information on sustainable development. It particularly targets the rural masses, addresses concerns their and provides reliable information for local use through as single

window. SDNP has launched a website (<http://sdnp.delhi.nic.in/>) for accessing information in this regard by a wide cross-section of users. State-of-the Art computer and communication network infrastructure has been created at SDNP central hub and provides web space/ web access with E-mail services to various stakeholders and target groups. Recent activities include launching of an electronic journal “Developments Today”.

SDNP-India aims to evolve into a complex network of organisations linked electronically and through an Association for mutual information sharing and benefit and for facilitating percolation of knowledge and information at grass-root level.

Monitoring Cell for Joint forest management (JFM): A cell has been created in the MOEF for monitoring the impact of the JFM programmes of which the key element is people’s participation. In addition, NGOs like WWF-India and Society for Promotion of Wasteland Development (SPWD) have their JFM networks, which periodically hold workshops to share experiences and to influence Government’s policy (MOEF, 2000).

Indira Gandhi Conservation Monitoring Centre (IGCMC): The IGCMC was set up by the Worldwide Fund for Nature (WWF-India) in 1994, with the support of the Government of India, Ministry of Environment and Forests. Its overall goal and purpose is to support biodiversity and natural resource conservation in India through collection, managing, disseminating and making accessible relevant data and knowledge, and by providing appropriate technical, analytical and networking services.

Information Dissemination on desertification, drought, climate, environment, water and energy:

(i) Desertification: The Central Arid Zone Research Institute, Jodhpur is one of the ENVIS centres functioning as a database on desertification, it is necessary to develop a networks at the national, state and district levels of monitoring activities covering the entire arid, semi-arid and dry sub-humid regions of the country. Collecting data/information on the impact indicators (see section 8.1) using remote sensing and GIS for developing a sound database would be an important function of these networks.

(ii) Drought: The satellite based National Agricultural Drought Assessment and Monitoring System (NADAMS) is established at the Department of Space (DOS). The programmes are being carried out by the National Remote Sensing Agency (NRSA). The Department of Agriculture and Cooperation, with support from state and central government departments, has sponsored NADAMS for providing reliable and accurate information on agricultural conditions. NADAMS uses daily NOAA-AVHRR (1.1 km) and IRS-WIFS (188 m) based biweekly/monthly vegetation index and provides periodic information on crop conditions at the district and sub-district level in terms of drought bulletin and detail reports. This programme at present covers 10 states of the country viz., Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Orissa, Rajasthan, Tamilnadu and Utter Pradesh.

National Data Bank Facility in Agro-meteorology: The National Data Bank is being set up under the All India Coordinated Project on Agro-meteorology at the Crop Research Institute for Dry Land Agriculture (CRIDA), Hyderabad.

(iv) Environment: Forest Survey of India (FSI): FSI is responsible for monitoring the state of India’s forest cover and acts as a repository of forest databases. FSI publishes every two years “The State of India’s Forest” giving an assessment of forest cover for different states of the country and comparative changes that have taken place during the two year period (FSI, 2000). The Wildlife Institute of India (WII), Dehradun,

which is one of the ENVIS centres, has in January 2001 brought out a Directory of Protected Areas (PAs) in the Country. The Bulletin is extremely useful for accessing information on location of PAs, people in charge and involved in the maintenance of PAs in all the States.

(v) Water: The Centre for Science and Environment has following the release of their book 'Dying wisdom' on traditional water harvesting systems in the country, has released Directory titled "WATER LINKS", which is a directory of individuals and organisations involved in water harvesting in India and overseas. It covers institutions, technical experts, consultants, grassroots activists from India and abroad that are relevant to water and water harvesting.

(vi) NGO Directory: The WWF, New Delhi has brought out a 14- volume directory of NGOs operating in the country on various sectors and programmes.

7.9.4.2 Awareness Raising

To generate awareness amongst the public, particularly school children, a number of activities are organised on various Days such as the World Environment Day (June 5), World Desertification Day (17th June), etc. Forest conservation activities during Vana Mahotsava are celebrated during the monsoon season, which is ideal for planting saplings across the country. The details of events observed by the Ministry of Environment and Forests (MOEF) are given below:

Table 7.9: List of Important Days in the Calendar Observed by the Ministry of Environment and Forests

S.N.	DATE	DAY
1.	2 nd February	World Wetlands Day
2.	21 st March	World Forestry Day
3.	22 nd March	World Water Resources Day
4.	7 th April	World Health Day
5.	22 nd April	World Earth Day
6.	5 th June	World Environment Day
7.	17 th June	World Day to Combat Desertification
8.	1 st -7 th July	Vana Mahotsava (Van = Forest, Mahotsava = Grand Festival)
9.	16 th September	International Ozone Day
10.	27 th September	World Tourism day
11.	2 nd -8 th October	Wildlife Week
12.	10 th November	Forestry Martyrs' Day
13.	25 th November	World Conservation Day
14.	4 th December	Chemical Disaster Prevention Day
15.	14 th December	Energy Conservation Day
16.	29 th December	International Day for Biodiversity

Source: MOEF

A number of other important areas are also relevant in the context of sustainable development, are observed through organisation of events and activities to promote awareness, for which a day has been dedicated for each of the areas. These are given below:

Table 7.10: Important Calendar of Events Observed by the Government India for Promoting Sustainable Development.

S.N.	DATE	DAY
1.	1 st February to 14 th February	Oil Conservation Fortnight
2.	8 th March	International Women's day
3.	24 th March	World Meteorological Day
4.	7 th April	World Health Day
5.	11 th July	World Population Day
6.	6 th October	World Habitat Day
7.	2 nd Wednesday of October	Natural Disaster Reduction Day
8.	14 th -20 th October	Natural Land Resources Conservation Week
9.	9 th to 14 th November	International week of Science and Peace
10.	14 th to 20 th November	Soil Conservation Week

Source: Ministry of Information and Broadcasting, Government of India, 1998

The Ministry of Environment and Forests regularly organises quiz shows, on-the-spot painting competition, debates, etc for school children on various issues with a view to sensitising them from an early age about environmental conservation. A number of awareness campaigns are also launched for children and youth on specific areas identified as the theme of the year. An example of a campaign for conservation and protection of trees is given in Box 7.15.

In line with the resolution adopted in 1994 in the UNCED in Rio in June 1992, the Ministry of Environment and Forests (MOEF) observes June 17th, the World Day to Combat Desertification each year. In 1999, MOEF organised an on-the-spot painting competition for children of different groups with a view to sensitising them on issues relating to land degradation and desertification. More than 600 children participated in the competition. Several NGOs, who have come together under the banner of RIOD-India (National NGO Network on UNCCD), have already undertaken various publicity measures. These comprise translation of UNCCD material on drought and Desertification in local languages, identification of historical reasons of droughts and desertification processes, organising workshops, and establishing their focal point for coordination amongst themselves. In addition, the concept of promoting conservation saplings are provided free in Government owned nurseries during the monsoon season. Environment forms an important ingredient of school curricula at all levels of education.

NATIONAL ENVIRONMENT AWARENESS CAMPAIGN (NEAC)

The National Environment Awareness Campaign (NEAC) started in 1986 for creating awareness at all levels of the society. The main theme for NEAC during 2000-2001 was: **“Keep our Environment Clean and Green”**. Under this major theme, attention was given to four sub-themes:

- Keeping our sources of drinking water clean and protected.
- Ensuring proper management of garbage and other solid wastes.
- Control of air pollution.
- Protection of trees and plantation including nurturing of new trees

Box. 7.17 School Campaign for Conservation and Protection of Forests in the Country

SAVE PAPER TO SAVE TREES



There are about 19,00,00,000 students in India.
 If every student saves one sheet of paper every day,
 19,00,00,000 sheets of paper will be saved per day,
 988 tonnes of paper will be saved each day,
 2748.54 tonnes of wood will be saved each day,
 which means in 200 working days in a year,
 5,49,708 tonnes of wood will be saved.

This will lead to a saving of about 33,00,678 trees per year by the students of India.

Source: Anonymous, 1997

ECO-CLUBS: To impart environmental education and to encourage and mobilise participation of school children in various environmental conservation activities in their localities, the MOEF provides financial assistance for setting up of Eco-clubs in schools.

FELLOWSHIPS AND AWARDS: A number of fellowships and awards are given to individuals or organisations every year by the MOEF for making significant contributions in the field of environment.

Table 7.11: Fellowships and Awards given by the Ministry of Environment and Forests

NAME OF AWARDS AND FELLOWSHIPS	RELATES TO
Indira Gandhi Paryavaran Puraskar (IGPP)	Instituted in 1987 consists of a cash award of Rs. 1 lakh, a silver trophy, a scroll and a citation. Awarded to an individual or an organisation for significant contribution to cause of environment.
Indira Priyadarshini Vrikshamitra Awards (IPVM)	Instituted in 1986 to give recognition to pioneering and exceptional contributions of individuals/organisations in the field of afforestation and wastelands development. Each award carries a cash of Rs. 50,000/-, medallion, a scroll and citation.
Mahavriksha Puraskar	Instituted in 1993-94 to give recognition to individuals/organisations for preserving and protecting trees of the notified species. Each award consists of a cash prize of Rs. 25,000/-, a Plaque, and a citation.
Zile ki Sabse Hari Panchayat (English Translation: The most green Panchayat in the Zila)	With a view to motivate Gram Panchayats to undertake afforestation activities from the funds available under the Rural Employment Generation and other plantation schemes, an Award was instituted by MOEF in 1995-96. A cash prize of Rs. 1 lakh is given to the best Panchayat.
Pitambar Pant National Environment fellowship	Awarded to a scientist engaged in research for preservation of environment.
B.P.Pal National Environment Fellowship Award for Biodiversity	Given to a Scientist working in the field of biodiversity conservation.

Dr.Salim Ali and Dr.Kailash Sankhala Fellowship	Awarded to eminent officers and field workers for exemplary work in the field of wildlife conservation and research.
Rajiv Gandhi National Wildlife Conservation Award	Awarded to both individuals and to institutions for wildlife conservation
Amrita Devi Wildlife Protection Award	Awarded to village communities for showing valour and courage in the protection of wildlife. Yet to be institutionalised.
National Award for Prevention of Pollution	Awarded to industries which make a significant and measurable contribution towards development and use of clean technologies, products or practices that prevent pollution and finding innovative solutions to the environmental problems.
Vishisht Vaigyanik Puraskar	Introduced in 1991-92 by the MOEF as an incentive to scientists working in MOEF and its associated offices. Presented on world Environment Day.

Source: MOEF Annual Report: 1999-2000

7.9.5 Role of Information Technology (IT) Sector in Sustainable Development and Combating Desertification

Information Technology is a recent tool for communication and dissemination of information for the sustainable development in the country (Box 7.16).

<p>Box. 7.18 Illustrative Examples of Use of IT in Rural Areas</p> <ul style="list-style-type: none"> • Dairy Industry - The Dairy Co-operatives of Anand in Gujarat are using IT applications to streamline procedures. • Women's Empowerment - The Self Employed Women's Association (SEWA) is using satellite communications in 12 centres in Gujarat to train women on forestry, water conservation, child development, health, education, Panchyati Raj, etc. • Agriculture - In Waranagar, Maharashtra, sugarcane farmers use computers in villages to interact with a sugar factory in town. Computers run on software developed by Co-operative Society. • Fisherfolk and Cell Phones - Some of the fishermen in Kerala use cellphones to land their catch according to the best price available while returning from a fishing expedition. • Education - The Rajiv Gandhi Shiksha Mission of the Madhya Pradesh Government is running 'Headstart' - a computer enabled education programme for rural children. Headstart supplements the Education Guarantee Scheme of the State Government. <p>Source: Down to Earth, CSE, February, 15, 2001</p>

A number of successful use of IT has been reported. One such example is the Gyandoot Programme of Madhya Pradesh which is a model for other States (Box. 7.17).

Other examples include the Pratham Project established in 1994 by UNICEF and the Municipal Corporation of Greater Mumbai with a mission to achieve "Universal Primary Education" in Mumbai.

Tarahaat.com: It is a portal for rural masses and has been in operation in a village in Uttar Pradesh.

A number of States have taken a lead in promotion of IT for various sectoral activities. The State Government of Andhra Pradesh is in the process of developing content in the local language, Telugu, to be delivered on networks to farmers in remote villages.

Box. 7. 19 Gyandoot Programme of Madhya Pradesh

(Gyandoot -Ambassador of Knowledge)

Prior to the use of computer to access market rates, farmers were dependent on the local broker for sale of their produce, who often duped the farmers. With the introduction of the Gyandoot programme in the district administration of Dhar district in Madhya Pradesh, 26 major information centres were connected through internet network, enabling the farmers to select a market where

Maximum price is being offered for his produce. The programme has also helped in streamlining the land revenue records. Each centre services about 15 *Gram panchayats* and about 25-30 villages. The benefits reach over half a million people in 600 villages. Under Gyandoot, a computer is installed in a 'Soochanalaya' (Information Centre) in a *Gram Panchayat*. Users of these centres are charged on the basis of services provided.

The computers are operated by unemployed youth who have completed high school. Their selection and training is done by the *Panchayats*. System maintenance is entirely their responsibility, as are all the running costs. There is no salary and the service charge is the only source of income. The Panchayat charges a commission of 10 per cent on the income. Any resident of Dhar can check the market rates on computers or demand copies of land records. They can e-mail complaints to the district administration.

"More such centres might be set up through funds from panchayats, private investors, and bank loans to individuals. In future, such centres can also be set up under the employment schemes" informs Collector, Dhar. Gyandoot, launched in January, 2000 was given the Stockholm Challenge Award for public service and democracy among 109 projects from across the world. **Source: Down to Earth, Feb. 15, p 30, 2001, CSE.**

On the lines of the Madhya Pradesh Government's 'Gyandoot Programme', the State of Himachal Pradesh has launched a similar programme in Hamirpur District of the State. Twenty Five Information Centres are proposed to be set up under the programme.

Source: February 28, p 15, Down to Earth, CSE,

7.9.6 Externally Aided Projects

Taking cognizance of India's sincere efforts for addressing desertification, a number of bilateral, multilateral and international donors are providing fund assistance in different areas of the country. A significant number of externally aided projects have been introduced in the sectors of agriculture, forestry, rural development, etc. in the recent years. These include:

Watershed Projects: These are primarily funded by the World Bank, DANIDA, Swiss Development, Cooperation (SDC), EEC, KFW, FAO/UNDP and the Government of Netherlands. The principle objectives under these complementary programmes are special area development and to develop a dynamic process of community participation with the support from NGOs.

R&D in Agriculture: A major Rs. 800 crore project aided by the World Bank has been initiated for R&D pertaining to agriculture with the ICAR institutions.

Forestry: Include projects such as afforestation of the Aravali Hills, Capacity building Project, Western Ghats Project, etc.

Rural Development: Watershed Development project, Project for Capacity building and Knowledge generation, Community Management of Natural resources, etc.

The detailed list of externally aided projects under implementation within the three ministries of Agriculture, Rural Development and Environment and Forests is given in Annex 10.

7.10 Drought Preparedness and Contingency Plan for Drought Management

7.8.9.1 Relief Measures for Drought Mitigation: When situations of drought occur in different States, the Central and State Governments undertake relief measures by providing drinking water, foodgrain, through the Public Distribution System (PDS), fodder, food subsidies to special groups and employment through food-for-work programme.

7.8.9.2 Drought Monitoring by the Centre and States: At the Centre, the Disaster management Division in the Ministry of Agriculture co-ordinates drought relief work with the State Governments. The National Centre for Disaster Management set up in 1995 undertakes human resource development, research studies, building of database and provides information services, and documentation on disaster management. Financial assistance to State Governments is provided from the calamity Relief Fund (CRF). In the wake of the severe drought in 2000, the Government set up a High-Power Committee (HPC) in the Ministry of Agriculture under the chairmanship of Mr.J.C.Pant, former Secretary, Ministry of Agriculture, to look into the gamut of problems of disasters and make recommendations. Some States (Karnataka) have set up Drought Monitoring Cells for providing information on agro-meteorology and other forms of assistance for drought mitigation and relief.

Chapter 8

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Chapter 8

Other Activities of the UNCCD and their Inter-linkages with NAP

Highlights of Chapter 8

This chapter briefly explains the UNCCD structure, functioning and activities. The specific activities planned/initiated at the sub-regional, regional, inter-regional and global level are explained in brief. The activities of the Conference of the Parties (COP) which is the supreme body for the implementation of the Convention, the Committee of Science and Technology (CST), a subsidiary body of the COP, are explained. The various funding mechanisms available and recommended and the issues arising from these are also covered.

8.1 Structure of the UNCCD

8.1.1 CONFERENCE OF THE PARTIES (COP)

Part IV – Institutions – Article 22 – Conference of the Parties prescribes that a Conference of the Parties, which is the supreme body of the Convention shall be established with the following mandate:

- Regularly review the implementation of the Convention and functioning of its institutional arrangements.
- Promote and facilitate the exchange of information on measures adopted
- Establish such subsidiary bodies as are deemed necessary.
- Review reports submitted by its subsidiary bodies
- Rules of procedure for itself and for the subsidiary bodies.
- Adopt amendments wherever necessary
- Approve programme of budget
- Utilise services and information by competent bodies or agencies, whether national, international, intergovernmental or non-governmental.
- Promote and strengthen the relationship with other relevant Conventions.
- Exercise such other functions as may be necessary for the achievement of the objective of the Convention.

All countries, which are signatories to the Convention, are a Party to the Convention and participate in the Conference of Parties (COP) for regular planning and review of activities under the Convention. In addition a number of international organisation, international donors, R&D institutions and NGOs also participate in the Conference of the Parties. Depending upon the bloc they belong to, as per definition in the UN, they are 'developed' or 'developing' country Parties. The summary of activities of the COP held so far is given in Table 8.1 Reports, decisions, and documents of the UNCCD, COP, CST, etc., are available on the website: www.unccd.int . The Structure of the UNCCD functioning is given in Figure 8.1.

The Conference of the Parties at the start of every Conference constitutes a temporary Committee of the Whole (COW) to deliberate on various issues identified in the Agenda for that particular Conference. The

COP in its third session held at Brazil decided to constitute an Ad-Hoc Working Group (AHWG) to review National Reports submitted by the Country Parties from all regions. The COP in its fourth session reviewed National reports of affected country Parties from different regions including Asia through AHWG, which also met at a resumed session in March 2001. COP-4 also considered proposals on procedures and modalities for the establishment of a Committee to Review the Implementation of the Convention (CRIC) which would report to the Conference of the Parties. The COP is held every year until COP-5 in year 2001. COP-6 (to be held in 2003) and every subsequent COP will be held once every two years.

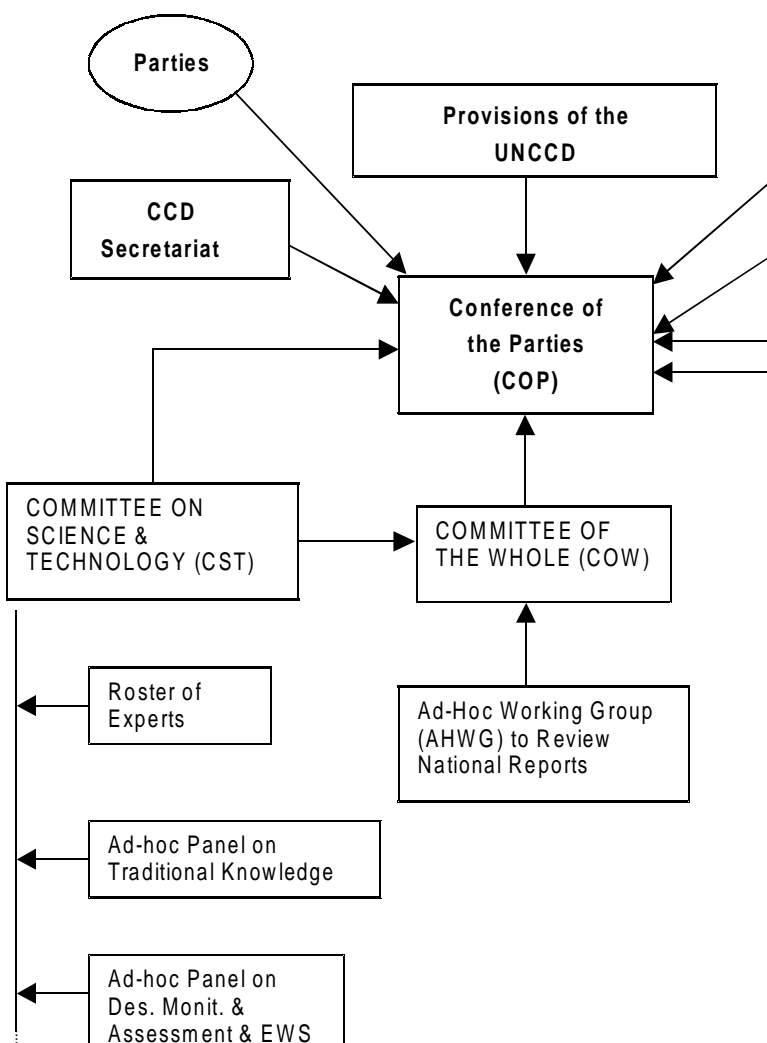
8.1.2 PERMANENT SECRETARIAT

The UNCCD was initially serviced by an Interim Secretariat located in Geneva, Switzerland. Since 1998, the UNCCD is supported by a Permanent Secretariat located in Bonn, Germany. The functions of the Permanent Secretariat established by Article 23 of the Convention includes: (i) to make arrangements for sessions of the COP and its subsidiary bodies, (ii) to facilitate assistance to affected developing countries for compilation and communication of information, (iii) to co-ordinate its activities with the secretariats of other relevant conventions, (iv) to prepare reports on the execution of its functions and to present to the COP.

Table 8.1: Summary of Activities of the Conference of the Parties to the UNCCD

CONFERENCE OF THE PARTIES (COP)	YEAR	DATE	VENUE	MAIN ISSUES TAKEN UP
COP-1	1997	Sept.29- Oct. 11	Rome, Italy	Work Programme of CST – Roster of Independent Experts, Programme and Budget for the Convention and for the Sect.
COP-2	1998	Nov. 30- Dec. 10	Dakar, Senegal	Establishment of a Permanent Secretariat, Regional Action Programmes, Preliminary discussion on NAP preparation. Review report of the Global Mechanism. CST- related issues. Ad-hoc Panel on Traditional Knowledge and its linking with modern technology.
COP-3	1999	Nov. 15- 26	Recife, Brazil	Presentations of National Reports of African Country Parties. Review work of the Global Mechanism. Establishment of an Ad-Hoc Working Group (AHWG) under the COP. Establish synergies amongst Conventions. CST related issues. Recife Initiative.
COP-4	2000	Dec. 11 -22	Bonn, Germany	Discussion on National Reports of Asia, Africa, Latin America & Northern Mediterranean in the AHWG. CST related issues. Discussion on constitution of CRIC.
COP-5	2001	Oct. 1- 12	Geneva, Switzerland	National Reports of all regions. More detailed discussion on Africa. Proposals on procedures & Modalities for CRIC. CST-Discussion on EWS, Constitution of Ad-Hoc panels, if required.

Fig. 8.1 Organogram showing the Organisational Structure of the UNCCD



8.1.3 COMMITTEE ON SCIENCE AND TECHNOLOGY (CST)

The Committee on Science and Technology is a subsidiary body of the Conference of the Parties created under Article 24 of the Convention, to provide information and advice on scientific and technological matters relating to combating desertification and mitigating the effects of drought. The CST reports to the Conference of the Parties and decides on scientific and technical issues. The CST has, since its constitution, deliberated on the following issues:

- Use of Traditional Knowledge in dealing with the problem of desertification.
- Desertification Monitoring & Assessment.

- Use of Benchmarks & Indicators. Use of Early Warning Systems (EWS) for drought mitigation.
- Creation of Roster of Experts on different sectors.
- Survey on Existing Networks, Institutions on different sectoral activities. (Article 25).

The COP may as necessary, appoint ad-hoc panels to provide the CST with advice and information on specific scientific issues for combating desertification. In pursuance of this, the CST, for its effective functioning to gather information on some of these issues has had two ad-hoc panels for assisting in providing information on:

- (i) Ad-hoc Panel on Traditional Knowledge
- (ii) Ad-hoc Panel on Desertification and Monitoring and EWS.
- (iii) Use of Benchmarks and Indicators

The CST also constituted a Roster of Experts to assist it in various issues on combating desertification drawing expertise on various cross-sectoral areas such as anthropology, sociology, health sciences, legislation, crop sciences, soil sciences, etc. Thirty six Indian experts figure in the Roster (details found in website: www.unccd.int). The CST also initiated an exercise of identifying all networks of institutions (governmental and non-governmental, R&D) involved in combating desertification and to establish a global network of networks. The Winrock International -India surveyed and compiled a list of Indian organisations involved in combating desertification in the country. The details of this are available on website: <http://ag.arizona.edu/CALS/CSTCCD>.

8.2 Regional, Sub-Regional and Inter-Regional Programmes of the CCD

Article 11 of the Convention specifies that affected country Parties shall consult and co-operate to prepare in accordance with relevant regional implementation annexes – sub-regional and/or regional action programmes to harmonise, complement and increase the efficiency of national programmes. There are four regional implementation annexes: (i) Africa, (ii) Asia, (iii) Latin America and Caribbean (GRULAC), and (iv) Northern Mediterranean. As part of this, regional and sub-regional action programmes to support and integrate with the efforts of the National Action Programmes can be established. Formulation of our National Action Programme is governed by Implementation Annex II for Asia under the Convention.

Box. 8.1. Regional (RAP) and Sub regional (SRAP) Action Programmes

The regional and sub-regional action programmes are intended to harmonise, complement and increase the efficiency of national action programmes (NAP). Examples of areas suitable for joint efforts are:

- Sustainable management of transboundary resources.
- Development of alternate energy resources,
- Capacity building, education and public awareness.
- Scientific and technical cooperation on climate and weather and water issues.
- Establishment of early warning systems for drought.
- Plans to address problems of migration.
- Trade issues.

8.2.1 REGIONAL (RAP) AND SUBREGIONAL ACTION PROGRAMMES (SRAP)

8.2.1.1 Regional Action Programme (RAP) for Asia

As mentioned in Chapter 1, the Asian region has the largest percentage of degraded lands and with the largest number of population threatened or at risk directly or indirectly due to adverse impacts of desertification (Chapter 2, sub-section 2.2). Keeping this in view, a number of activities have been taken for the establishment of a regional cooperation amongst affected Asian country Parties.

Box. 8.2. RAP for Asia considers the following as its key objectives:

- To develop a regional framework consistent with the objectives of the Convention, which advocates an integrated approach in combating desertification and drought, addressing the physical, biological and socio-economic aspects of the processes.
- To strengthen subregional, and regional institutions by harmonising policy directions and enhancing technical collaboration through a network of institutions, technology sharing, application of research findings, provision of training and assistance in preparing or identifying investment opportunities.
- To provide a basis for the consolidation of the national long-term goals for combating desertification and work towards the harmonisation at subregional and regional level of efforts in achieving the goals.
- To establish the appropriate institutional mechanisms that promote the conclusion of partnership arrangements and involve bilateral and multilateral financial institutions in order to channel substantial resources for regional cooperation in Asia.

(1) First Regional Conference on the Implementation of the Convention in Asia held in New Delhi in August 1996. The Conference identified the following key elements of cooperation amongst Asian countries:

- Scientific Cooperation and Technological Transfers.
- Public Participation and Consensus Building.
- Education Curricula Promotion and Awareness Raising.
- Capacity and Institution Building.
- Regional Cooperation and Land Degradation across Different Climatic Sub-Regions.
- Research Study on the Enabling Macro-policy Framework.

(2) Ministerial Level Conference of Asia held at Beijing in May 1997. The Ministerial Conference conceptualised a framework for the formulation of the Regional Action Programme (RAP) and development of NAP. The Conference decided to establish a Network of thematic areas and identified six Thematic Programme Network areas for co-operation amongst the affected countries. These are:

- TPN -1: Desertification Monitoring and Assessment.
- TPN -2: Agroforestry and Soil Conservation in Arid, Semi-arid and Dry Sub-humid areas.
- TPN-3: Rangeland and Pastureland Management in Arid areas including fixation of sand dunes.
- TPN-4: Water Resources Management for Agriculture in Arid, Semiarid, and Dry Sub-humid areas.
- TPN-5: Strengthening Capacities for Drought Impact Mitigation and Combating Desertification.
- TPN-6: Assistance for Development of Integrated Local Area Development (LADPs)

(3) An International Expert Group (IEG) Meeting on the Regional Action Programme (RAP) for Asia was held at ESACP, Bangkok in November 1998 to further discuss the preparation of RAP for Asia. The meeting was attended by about 65 decision makers and experts representing Asian and donor countries as well as international organisations and NGOs. The participants decided that TPNs would be formulated and implemented building upon existing knowledge and experience as well as strengthening partnership. Flexible modalities of cooperation were acknowledged as guiding principle to develop TPNs. It was recommended that regional and international financing institutions lend their technical and financial support to the preparation and implementation of NAP.

8.2.1.2 Establishment of Thematic Programme Network for Asia

TPN-1 on Desertification Monitoring and Assessment

The focal point for TPN-1 is China. The Space Applications Centre (SAC), Ahmedabad has been identified as the Technical Co-ordinating institution in India that would co-ordinate the national efforts on desertification monitoring and assessment with the regional action programme for Asia. Dr. Ajai, Director, FLPG in SAC is the technical co-ordinator.

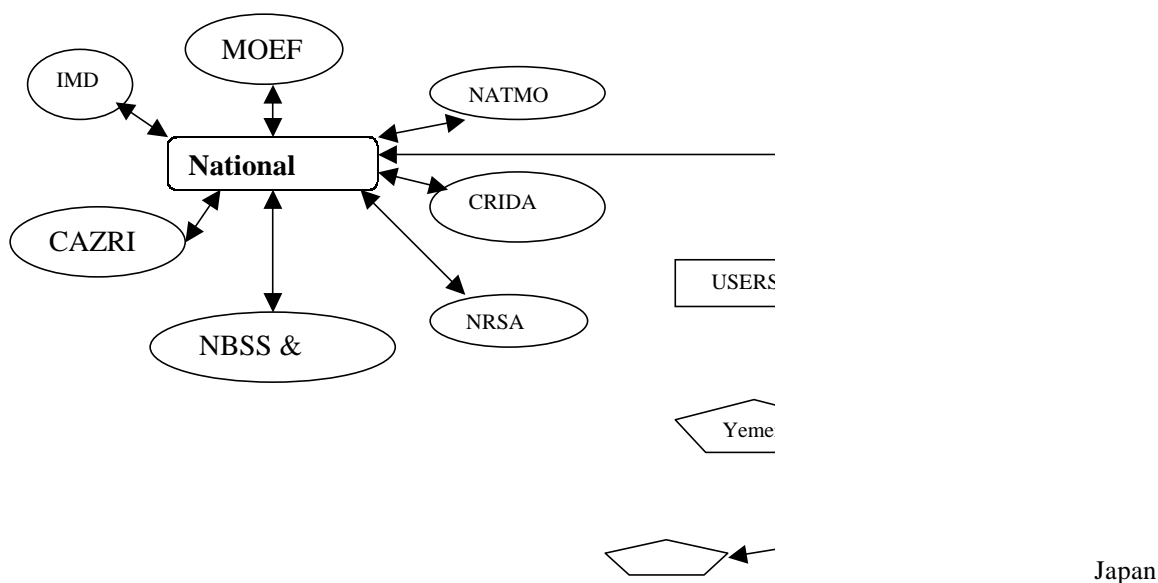


Fig. 8.2 Concept Prepared by Dr. Ajai, Space Applications Centre, Ahmedabad and Technical coordinator for TPN-1 on the Establishment of TPN-1 on Desertification Monitoring and Assessment.

TPN-2 on Agroforestry and Soil Conservation in Asia

The Government of India, while endorsing the six TPNs, offered to be the host of TPN-2 on “Agroforestry and Soil Conservation in dryland regions of Asia”, which was approved. In consultation with the Indian Council of Agricultural Research (ICAR), the Central Arid Zone Research Institute was identified as the Nodal technical institution to promote the activities of TPN-2 at a regional level. TPN-2 was formally launched in New Delhi-Jodhpur in March 2000. Representatives from 14 countries, CCD Sect. at Bonn and the Regional Coordination Unit (RCU), Bangkok, Asian Financial Institution such as the ADB and representatives of donor countries, donor agencies and international organisations such as the UNDP, UNEP, etc participated in the launch.

Table 8.2: Status of the Asian TPN Programme is given below:

TPN	TPN- Area	HOST COUNTRY	INDIAN TECHNICAL INSTITUTION COUNTERPART
TPN-1	Desertification Monitoring & Assessment.	China	Space Applications Centre (SAC), Department of Space, Ahmedabad
TPN-2	Agroforestry and Soil Conservation in Arid, Semi-arid and Dry Sub-humid areas	India	Central Arid Zone Research Institute (CAZRI), Jodhpur
TPN-3	Rangeland and Pastureland Management in Arid areas including fixation of sand dunes	Iran	Not yet Identified
TPN-4	Water Resources Management for Agriculture in Arid, Semiarid, and Dry Sub-humid areas	Syria	Not yet Identified
TPN-5	Strengthening Capacities for Drought Impact Mitigation and Combating Desertification	Mongolia	Not yet identified
TPN-6	Assistance for Development of Integrated Local Area Development (LADPs)	Pakistan	Not yet Identified.

At the sub-regional level, action programmes have been formulated by East Asia (China-Mongolia-Korea and Japan), Central Asia (Turkmenistan-Kazakhstan-Kyrgistan, etc.), West Asia (Syria, Jordan, Lebanon, etc.).

8.2.2 ACTIVITIES AT THE INTER-REGIONAL AND GLOBAL LEVEL

8.2.2.1 Early Warning Systems (EWS)

Early Warning Systems is one of the main issues that has been reviewed at the Inter-regional activities under the UNCCD and has resulted in the organisation of two Afro-Asia Forum of Early Warning Systems and a Technical Workshop following it. The First Afro-Asia Forum of EWS was held in Beijing during August 1996 to exchange experiences and explore areas of collaboration in combating desertification and mitigating the effects in the two continents. The second Forum was held in Niamey, Niger during September 1997 with the objective of providing the Committee on Science & Technology an evaluation of the prospects of integrating EWS with environmental information on desertification. The workshop also recommended the development and testing of practical examples of such an integration. A representative from the former Ministry of Rural Areas and Employment, Mr.A.R.Subbaiah, participated in this Forum. The Asia-Africa Technical Workshop on Early Warning Systems was held in July 1999 at Beijing, China which is the host for TPN-1 under RAP for Asia. This workshop was participated by Dr.Ajai, Space Applications Centre, Ahmedabad. In addition, another inter-regional forum between Africa-Latin America & the Caribbean was held in Recife, Brazil in October 1998. These are aimed towards exchange of practical experience, development of Asia-Africa training, research cooperation, collection, analysis and exchange of data in some specific field of selected areas of the Forum. A great amount of potential has been identified in EWS in preventing desertification and drought mitigation. The major recommendation is that affected countries of the region, may strengthen and/or establish information, evaluation and follow-up EWS taking into account the climatic, meteorological, hydrological, biological and other relevant factors.

8.2.2.2 Assessment of Status of Land Degradation in Dryland (LADA) and the Millennium Ecosystem Assessment (MA)

LADA: The necessity for having basic standardised information and methodological tools for land degradation assessment at various levels has been echoed by Parties and other relevant actors. This includes an assessment of the impact of land degradation on sensitive ecosystems and international waters, such as shared river and lake basins and watershed, and coastal ecosystems. The UNCCD Secretariat is collaborating with the UNEP and FAO amongst other key players with support from GEF to facilitate a project on dryland land degradation assessment (LADA), with a view to assessing both the level and trends of degradation of natural resources and environmental driving factors that cause this degradation. This is a global initiative that will target areas affected by drought and desertification. LADA is planned for a period of ten years (2000-2010).

MA: The Millennium Ecosystem Assessment (MA) is a four-year process designed to improve the management of world's natural and managed ecosystems by helping to meet the needs of decision makers with scientific information on the conditions of ecosystems, consequences of ecosystem change and options for response. The MA is presently engaged in an exercise to select and design the sub-global components of the MA process. Southern Africa and South-East Asia have been selected as two of the focal regions for the sub-global component of the MA process. The MA has a core budget of US \$ 21.1 million, contributed by GEF, UN Foundation, Packard Foundation, Government of Norway, Rockefeller Foundation, World-Bank, UNEP, FAO, UNESCO, UNDP and NASA.. Amongst other activities proposed for the year, a workshop is being finalised scheduled for October, 2001 on "Remote sensing and the Millennium Assessment" at Yale University, USA co-sponsored by NASA and potentially by remote sensing agencies in other countries. Details of the MA can be accessed from <http://www.ma-secretariat.org>.

Summary of the UNCCD activities at the national, regional, sub-regional, inter-regional and global levels is given in Table 8.3.

8.3 Interlinking National Efforts with Regional, Sub-Regional and Inter-Regional Activities for Combating Desertification

ISSUES RELATED TO THE COMMITTEE ON SCIENCE & TECHNOLOGY (CST)

8.3.1 Use of Benchmarks and Indicators

The general observation is that most countries including India do not use a scientifically based and verifiable set of benchmarks and indicators for monitoring and assessing desertification. It is for this reason that the CCD and its annexes make provisions for countries to report their progress in solving the problem. Monitoring of the CCD demands two major types of indicators - Implementation and Impact indicators. Implementation Indicators are those that can be used to track the progress of programmes and activities put in place by the countries that have ratified the Convention. Impact Indicators follow the effects of programmes and activities on desertification in general. They will reflect the success of the activities taken to address the problem. They measure the effects on natural resources, the economy, society and institutions. They may cover bio-physical, socio-economic and/or institutional aspects of the problem.

Table 8.4: USE OF IMPLEMENTATION AND IMPACT INDICATORS

TYPE OF INDICATOR	CHARACTERISTICS	USERS
Implementation	<ul style="list-style-type: none"> - Reflect progress and steps in implementing the CCD. - Measure the development and implementation of NAP. - Show progress in Partnership arrangements, the involvement of local people and NGOs. - indicate appropriate regulations, or legislation. - Can be applied at level of Convention, NAP or project. 	National and Sub-regional Coordination Committees, political decision makers, Conference of Parties, Donors, NGOs, etc.
Impact	<ul style="list-style-type: none"> - Measure the impact of CCD. - The state of natural resources, reflecting the containment of desertification. - The State of the economy. - The strength of the society. - The presence and capacity of institutions. - Can be applied at global, regional, sub-regional, national and local level. 	Political decision makers, National Ministries and Departments, Technical Experts, Economists, Donors, Local Communities and Other Partners.

Criteria for selection of indicators

While selecting the impact indicator the following criteria should be kept in view.

- Reliable and scientifically valid.
- Independent of sample size.
- Be measurable (standardised, accurate method and analysis with low measurement error).
- Biologically and socially relevant.
- Sensitive to stress factors without high natural variability and therefore has an early warning function.
- Easy and cost effective.
- Able to assess trends over time (Benchmarks).
- Be based on readily available data of known quality.

Impact Indicators

Keeping in view the above criteria, a suggestive list of impact indicators is given in Table 8.5.

USE OF BENCHMARKS AND INDICATORS IN INDIA

The Working Group I constituted under the National Steering Committee on NAP formulation on Desertification Monitoring and Early Warning System have deliberated on many facets especially as regards data required for the diagnosis and effective control of desertification. One of the important observations is that data are scattered in many organisations/departments of the Government. Much of these are in different forms and formats and are of varying qualities. It was recommended that an account of the on-going work on indicators as well as experience acquired in other sectors/conventions e.g. biological diversity, climate change, forestry and soil conservation be first consolidated to avoid duplication of effort. The International Crop Research Institute for Semi-Arid Tropics (ICRISAT) at Hyderabad has been using mainly soil loss index for monitoring progress of desertification. The IMD has suggested the following indicators, which can be used to assess desertification:

- Intensity of solar radiation.
- Variation in the runoff of flood waters and solid runoff.
- Variation in soil depth.

Table 8.3: Activities of UNCCD at Various Levels in the Context of Combating Desertification in the Dryland Regions

NATIONAL	SUB-REGIONAL	REGIONAL	INTER-REGIONAL	GLOBAL
<p>1. On-going Central Sector/ Centrally Sponsored Schemes, Programmes and Projects:</p> <ul style="list-style-type: none"> - Desertification Monitoring & Assessment. - Soil & Water Conservation. - Natural Resource Management. - Local area development programmes. - Awareness Raising. - People's participation. - R&D activities. - Institutional Strengthening & Capacity Building. <p>2. Programmes of the State Govt.</p> <p>3. Externally Aided Projects On-going as well as new.</p> <p>4. Projects arising from NAP.</p> <p>5. Developmental activities & Measures formulated at the local level.</p> <p>6. Various measures identified and decided from time to time.</p>	<p>1. Concerns sub-regions such as South Asia, West Asia, Central Asia, East Asia, South-East Asia, etc.</p> <p>2. South Asia has yet to formulate programmes on CCD related activities.</p> <p>3. Areas that could be considered include:</p> <ul style="list-style-type: none"> - Establishment of sub-regional programmes, monitoring & assessment on desertification & drought phenomena. - Sub-regional co-operation on land degradation and eco-restoration. - Exchange of R&D for drought prone/desert areas. - Traditional technologies in use in the region. - Local capacity building. 	<p>1. Concerns regions such as Asia., Africa, Latin America, etc. as a whole.</p> <p>2. Establishment of six Thematic Programme Network (TPN) for Asia.</p> <p>These are:</p> <ul style="list-style-type: none"> - Desertification Monitoring & Assessment. - Agroforestry & Soil Conservation. - Sand dune stabilisation in rangeland and pasturelands. - Water conservation in agriculture. - Drought preparedness. - Local Area Dev. Programmes. 	<p>1. Concerns two or more Regions such as Africa-Asia, Asia-Africa-Latin America, etc.</p> <p>2. Cooperation on studies on Early Warning Systems, through Inter-Regional Forums on EWS, etc.</p>	<p>1. Concerns the whole world and global effects/ phenomena, such as El-Nino/ENSO, La-Nina, etc.</p> <p>2. Global monitoring & Assessments on Land Degradation.</p> <p>3. CST related activities.</p> <p>4. Synergies amongst Conventions.</p> <p>5. Establishment of EWS on drought.</p>

- Variation in depth and quality of ground water.
- Monitoring of desert locust menace - monitoring the flight of desert locust from their origins in Africa and Arabia. The IMD has established seven Upper Air Observatories at Amritsar, Barmar, Churu, Deesa, Jaisalmer, Kota and Sriganaganagar.

Table 8.5: A suggestive list of Impact indicators to monitor desertification

Physical	Biological
<p>Climate Indices of temperature and Rainfall levels. Evapotranspiration. Precipitation tendencies Albedo</p> <p>Soil Surface run-off. Visual erosion or soil loss. Sediment in suspension. Soil compaction. Salinisation of soil. Soil fertility. Organic matter.</p> <p>Water Water table potential and use Groundwater decline, Salinisation. Volume of water bodies.</p> <p>Land use Crop and livestock productivity.</p>	<p>Flora Changes in vertical structure (Percent cover). Changes in horizontal structure (Strata). Changes in dominant species (Species dominance). Changes in richness and species diversity (index of diversity). Changes in phyto-volume.</p> <p>Fauna Density, abundance and rarity of species Livestock pressures.</p> <p>Socio-economic and Demographic indices Income. Percentage Infant mortality. Agriculture income/Total income Collection time for fuel-fodder-water needs of the day. Nutrition status by age and sex. Age specific literacy rate by gender. Migration from degraded lands. Percentage of population aware of desertification phenomenon.</p>

Box 8.3: USE OF BENCHMARKS & INDICATORS FOR DESERTIFICATION MONITORING & ASSESSMENT

In a study conducted in Thar desert, six desertification processes viz., vegetation degradation, wind erosion resulting in sand drift, quarrying and mine spoils, expansion of settlement, over grazing of village commons, depth of groundwater table, salinity and fluoride levels of ground water were taken as indicators for assessing the impact of desertification. Analysis of the topographical sheets of 1960-61 and Landsat Thematic Mapper (TM) data of 1986 revealed that only 10% of the open scrub land is left in the study area and the area under forest cover decreased by 50%. Area under loose hummock sand, which was only 5% of the total area in 1960-61, doubled in 1986. Similarly, urban expansion had increased four fold and quarrying six folds since 1960-61. Desertification being a self-propelling mechanism, the cumulative effect of its processes in arid and semi-arid regions has been leading to desert-like terrain devoid of all regenerative forces. It can only be checked by discouraging cultivation of marginal lands, and through controlling overgrazing, deforestation, decrease in livestock population, unscientific irrigation practices, and population increase

(K. Ramachandran, 1992) in **Regeneration of Degraded and Wasteland, Institute of Economic Growth, New Delhi as part of UNDP/MOEF Funded Project.**

Use of Implementation Indicators at the National Level.

For proper monitoring and evaluation of implementation of the Convention to Combat Desertification (CCD) it is proposed to follow a logical framework (lograme) approach which will list different components viz. Output

and activities, indicators of achievements, actual achievement, source of verification and responsible unit. For example, CCD implementation processes are (i) awareness creation about the Convention and identification priorities, (ii) formulation of National Action programme (NAP) and (iii) implementation of field projects/ activities within the framework of NAP, particularly people's participation, not just the technical work, undertaken by the project.

For monitoring and evaluation of NAP projects to be implemented a log-frame for each project has to be developed. Besides, intervention components, means of verification (MOV), and risk and assumption, the objectively verifiable indicators (OVI) are an important part of a log-frame matrix. The indicators have to relate to goal, purpose, outputs and means. Table 8.5 illustrates an example of logical framework matrix to monitor institution-building activity of a project on combating desertification with people's participation.

For successful implementation of a project it is necessary to identify risks and assumptions. These are statements about uncertain parameters affecting an intervention level in the logical framework matrix, which should be reflected in strategic and tactical considerations.

The evaluation parameters used by the Department of Agriculture and Cooperation for their Projects on Rainfed areas encompasses a set of indicators -physical, biotic, and socio-economic aspects, which are very useful in determining the success of the programme (Chapter 7, section 7.1.5). The on-going exercise under the Task Force set up in the Planning Commission to rationalise and integrate the projects and schemes of the MOA, MOEF and MORD has an element to introduce a more meaningful and evaluation mechanism for monitoring of schemes. It is however important that a study covering all regions and programmes be undertaken to select a verifiable set of indicators which can be used to assess the progress of desertification both temporally as well as spatially.

8.3.2 Integration of Use of Traditional/Indigenous Knowledge with Modern Technologies

A lot of information is available within the country on the use of traditional technologies in various aspects - agriculture, rainwater harvesting, drought management, livestock management, weather forecasting, etc. However, there is a dire need to consolidate this information and make it accessible to all users even in regions, where they are not in use, so as to obtain maximal benefits of integration of these activities with the national efforts for preventing and combating desertification.

8.3.3 Desertification Monitoring and Assessment and Use of Early Warning Systems (EWS)

Participation in UNCCD Activities at the Regional, Inter-regional and Global Level

As a first step, it is important that the key institutions and organisations, experts, professionals and others involved in various disciplines and aspects of the desertification governing the physical, biological, socio-economic and climatic aspects of desertification are identified. A roster of experts requires to be prepared for the active participation of these experts in the various activities of the UNCCD both at the national as well as at the international level in the context of the UNCCD.

Table 8.6 Logical framework matrix for institution building of a project on combating desertification with people's participation.

Intervention Component	Indicator Group (OVI)	Means of verification (MOV)	Risk/Assumption
<p>Strategic Level: Long-term development objectives Sustainable arid equitable management of rehabilitated common lands (CL) with the active participation of village-level institutions and local communities.</p>	<p>Establishment of village level institutions. Awareness level of the institution and villagers. Functioning of village level institutions.</p>	<p>6 months progress reports</p>	<p>Target population willingness to participate. Stable project environment with special respect to staffing.</p>
<p>Tactical Level: Immediate objectives xxxx ha of common lands rehabilitated and managed by xxxx Village Committees (VCs) with extension provided by the project authority.</p>	<p>Establishment of VCs. Awareness level of the VCs and Villagers. Functioning of VCs.</p>	<p>6 months progress reports. Forester/ SDO/DFO records. VC Interviews</p>	<p>Target population willingness to participate. Stable project environment with special respect to staffing.</p>
<p>Tactical Operational level : Output VCs established which manage CL on the basis of approved Village Management Plans (VMP).</p>	<p>No. of VCs established.</p>	<p>6 months progress reports.</p>	<p>Stable project environment with special respect to staffing.</p>
<p>Tactical-Operational level : Information and mobilisation activities. Community organising activities. Continual extension and counselling activities.</p>	<p>Sample Indicators: No. of campaigns. Publicity material distributed. No. of VMPs. Frequency of community/project staff meetings at different levels etc.</p>	<p>6 months progress reports.</p>	<p>Stable project environment with special respect to staffing.</p>

(RN Kaul, 2001)

8.3.4 Principal constraints to integration of NAP into UNCCD programmes and activities at the sub-regional, regional, inter-regional and global level

- Lack of financing.
- Lack of participation of all relevant organisations, departments and agencies actively involved in the area of activity in the activities at the national and regional/sub-regional and global levels.
- Lack of coordination between different agencies at the national and at the regional levels.
- Lack of awareness of impacts on economic and social issues.
- Lack of awareness of the UNCCD and its activities.
- "Desertification" as a term for land degradation and the UNCCD's approach of addressing only the dryland regions are not familiar within the national level programmes and activities. Greater awareness on these issues is required.

- Preparation of projects and activities under the UNCCD for national level initiatives is yet to begin.
- Facilitation process for fund access from the UNCCD has been so far slow.

8.4 Institutional Arrangements under the UNCCD

There are a number of financial institutions, R&D and other organisations and agencies of international, regional, global level which are involved in the formulation and implementation of the Convention. These include international organisations such as the UNDP/UNSO, UNEP, WMO, FAO, IFAD, World Bank and regional banks such as the ADB.

8.5 Synergies of UNCCD with Other Conventions

- UNCCD-UNFCCC
- UNCCD-CBD
- UNCCD-Forest Principles
- UNCCD- Ramsar Convention

Article 8 of the UNCCD refers to the linkages with other Conventions. In addition in every COP the efforts to strengthen the collaboration with the Rio Conventions and with other Conventions related to sustainable development have been emphasised.

Box 8.4. RATIONALE FOR SYNERGIES AMONGST RIO CONVENTIONS

- They share a common sustainable approach and the same basic principles enshrined in the Rio Declaration.
- The Conventions have a ramification on not only ecological but also the socio-economic and institutional aspects.
- Several of the policies and measures suggested for achieving the objective of one Convention may also contribute to objectives of others.
- Often, decision and policy makers of one Convention belong to the same Governmental organisation dealing with closely related portfolios such as the other Conventions or directly play a role in its implementation.
- Joint efforts that could be mutually beneficial in achieving sustainable development.

Source: UNDP

8.5.1 Linkage between Desertification and Biodiversity

Topsoil erosion leading to loss of nutrients, organic matter. Vegetative cover protects the topsoil from both water and wind erosion. The critical living organisms in a pastureland are the pasture plant species. The variability amongst these is essential for the sustainability of livestock farming. Different livestock have different forage preferences and therefore, greater diversity of forage plant species results in greater stability and profitability of their livestock economy. The within-species variability is also critical for breeding and improved vigour. Loss of dryland biodiversity can impact on loss of livestock, especially during drought and famine.

8.5.2 Linkage between Desertification and Climate Change

Desertification is closely inter-dependent with reductions in global carbon sinks and reservoirs. Desertification and the loss of vegetative cover increases the albedo-reflectance properties of the soil surface. Under specific circumstances, increased albedo reduces local precipitation, exacerbating the process of desertification.

8.5.3 Linkage between Desertification and Ramsar Convention

Protection of wetlands is not only important from the point of conservation of natural resources (flora and fauna) but also is an indicator of stability of the ecosystem.

8.5.4 Linkage between Desertification and Forest Principles

Forests being an important natural resource and have helped in regulating climate. They are also important for meeting the needs of fuel, fodder. Conservation and protection of forest is an important component towards arresting desertification.

8.6 Funding Mechanisms under UNCCD

Prevention and control of land degradation, primarily desertification and deforestation, are critical to achieving sustainable development. The consequences in terms of loss of biodiversity, reduced atmospheric and subterranean carbon sequestration and pollution of international waters can be significant and have global implications. For addressing the problem of desertification occurring across the globe, the magnitude of extent of funding required is enormous. For illustration, the UNCED Secretariat has estimated that the average total annual global cost of implementing the activities of Chapter 12 of Agenda 21 (Combating Desertification) along with other relevant chapters as given in Table 8.7 .

Table 8.7 Cost of Implementing Activities of Agenda 21 for Combating Desertification in the dryland regions globally.

Chapter #	Major Programme Areas	Major Global Activities	Annual Global Costs for Implementation (in US \$)
Chapter 12 - Combating Desertification & Drought	1. Strengthening knowledge base & Dev. Inf. & monit. systems for regions prone to desert. & drought, inc. socio-economic aspects.	Management related activities. Data & Information Inter. & reg. Cooperation.	350 million of which 175 from inter.community as grant/loan on concessional terms.
	2. Combating land degrad. thru' Intensified soil conservation, afforestation activities.	Direct preventive measures. Accelerated afforestation prog. Direct corrective measures. Promote and introduce improved land/water/crop management systems, combat salinisation in irrigated crop-lands, promote incentive measures, use of energy which will lessen pressure including alternate sources & improved stoves.	6 billion (3 billion from International community)
Chapter 3	3. Strengthening integrated dev. Prog. for eradication of poverty & promotion of alternate livelihood systems in areas prone to desertification.	Adopt policies at national level for decentralised approach to land-resource management. Create/strengthen rural organisations in charge of village Pastoral land management. Establish intersectoral mechanisms	Indicated under and Chapter 14
	4. Dev. Comprehensive anti-desert. prog. & integrating them into national dev. plans and national env. planning.	To handle env. & dev. consequences of landuse and land ownership, particularly to property rights of women. Promote rural credit.	

Chapter 8 Other Activities of the UNCCD and their Inter-linkages with NAP

	5. Dev. Comprehensive drought preparedness & drought relief, schemes including self-help arrangements for drought prone areas & designing prog. to cope with env. refugees.	Dev. infrastructure by involving local people to alternate livelihood systems & poverty alleviation programmes. Data & information. Inter. & Regional cooperation & coordination.	
Chapter 3 - Combating Poverty-enabling the poor to achieve sustainable livelihoods	1. Empowerment of local communities. 2. Alleviate poverty & to attain sustainability. 3. Long-term strategy aimed at elimination of poverty know-how Assist the most disadvantaged groups - women, children & youth, & refugees.	Promote sustainable livelihoods. Participation of local communities in sustainable management. Establish grass-roots mechanisms for sharing/exchange of & inequities.	30 billion (15 billion from Inter. Commun. as grants or concessional
Chapter 4- Promoting sustainable dev. thru. Agriculture & Rural Dev.	1. Review of Agr. Policy, planning & integrated programming in the light of multifunctional aspects of agriculture, particularly w.r.t. food security & sustainable development. 2. Ensuring people's participation & promoting human resource dev. for sustainable agriculture. 3. Improving farm production & farming systems through diversification of farm & non-farm employment & infrastructure develop. 4. Land-resource planning information & education for agriculture. 5. Land conservation & rehabilitation. 6. Water for sustainable food prodn. & sustainable rural develop.	National Policy reviews on food security Review national & reg. Agr. policy w.r.t. foreign trade, price, exchange rate, agr. subsidies & taxes, as well as organisational & economic integration. Implement policies to influence land tenure & property rights. Consider demographic trends & identify critical areas for agr. prodn. Low-input sustainable agricultural systems (LISA) Support national & regional EWS thru' food-security assistance schemes. Review policies w.r.t. improving harvesting, processing, distribution & marketing of products. Formulate & implement integrated agr. Projects that include other natural resource activities such as management of rangelands, forests, wildlife. Promote social & economic research & Policies that encourage sustainable agr. Identify storage & distribution affecting food availability. Data and Information systems. International & Regional coop. & coordination.	Cost for 1: 3 billion (450 external assistance) Costs for 2: 4.4 billion (650 thru' external funding) Costs for 3: 10 billion (1.5 billion thru' external funding) Costs for 4: 1.7 billion (250 million thru' external funds). Costs for 5: 5 billion (800 million thru external funding) Cost for 6: 600 million (of which 300 million thru' external sources)

Note: There are 40 chapters in Agenda 21 addressing various measures and activities governing sustainable development. Costs of each of these areas and the activities therein at the global level have been estimated under their respective chapters.

Source: Agenda 21: United Nations Conference on Environment & Development (UNCED), Rio de Janeiro, June 3-14, 1992.

8.6.1 GLOBAL MECHANISM (GM)

The Convention has prescribed for a Global Mechanism (GM), a multi source, multi-channel financing mechanism for facilitating and mobilising financial resources. The Convention under Article 21 states: “ In order to increase the effectiveness and efficiency of existing financial mechanisms, a Global Mechanism to promote actions leading to the mobilisation and channeling of substantial financial resources, including for transfer of technology, on a grant basis, and/or on concessional terms, to affected developing country Parties, is hereby established”. The Convention also provides for partnerships with international organisations and funding agencies as a source for generating funding. At COP-1 held in Rome in September 1997, it was agreed that the GM would be housed in International Fund for Agricultural Development (IFAD). Subsequently, the Managing Director for the GM was identified and a secretariat for the functioning of the GM was established. A Facilitation Committee of the GM consisting of representatives of various international organisations and agencies such as the UNDP, IFAD, World Bank was constituted.

The GM's main task so far has been to collect and disseminate information on the financial needs of affected developing country Parties for carrying out action programmes and other relevant activities related to the implementation of the UNCCD. The GM is also identifying and drawing up an inventory of relevant bilateral and multilateral cooperation programmes, as well as other sources and channels of funding patterns and eligibility criteria. The GM has with these guiding principles established a demand-driven Information System called ‘Financial Information Engine on Land Degradation’ (F.I.E.L.D.) in May 2000. This system is intended to be instrumental to the financial function of the GM and to its efforts to foster partnerships, improve communications and coordination between sources and recipients of funding and technical assistance related to the implementation of the UNCCD as well as with other interested institutions, organisations, bilateral and multi-lateral agencies, foundations, academic institutions, networks, bodies dealing with land degradation issues.

8.6.2 GLOBAL ENVIRONMENT FACILITY (GEF)

Unlike the other environmental conventions that emerged from the Earth Summit (UNFCCC, CBD) the UNCCD did not establish any particular fund for financing desertification programmes such as the Global Environmental Facility (GEF). Funding from GEF would be available, in so far as land degradation relates to the GEF Focal areas, namely; Climate Change, Biodiversity, and International Waters (ozone depletion which is the fourth GEF Focal Area is not relevant here in the context of desertification) and have agreed to fund the incremental costs of activities concerning land degradation within the GEF outline.

The strategic approach to support activities, which will keep the focus on global benefits of the GEF focal areas arise from the undertaking of the fund-assisted projects. The activities would be geared by achieving global environmental objectives through merging the projects into the mainstream of ongoing and planned developmental efforts, activities and programmes such as proper land use planning and implementation which often requires coordinated national, subregional and regional efforts.

8.6.3 OTHER INTERNATIONAL DONORS AND AGENCIES

The other donor agencies and organisations include: Asian Development Bank with a proposal (RETA) to consider NAP formulation and implementation in nine affected developing countries of Asia (including India), the International Fund for Agricultural Development (IFAD), Food and Agricultural Organisation (FAO), etc. A number of donor countries would also consider supporting NAP initiatives.

Box.8.5. Activities on Land Degradation as they Relate to the GEF Focal Areas

GEF PROJECTS ON LAND DEGRADATION AND CLIMATE CHANGE

GEF funded activities in the interface between carbon emission and reduction, and prevention and control of land degradation could include:

- Sustainable landuse planning and management.
- Regional cooperation to achieve them, to enable countries to secure better correspondence between land capability and use.
- Furthering the use of solar, wind and biogas energy for lighting, water heating, cooking, water pumping and other needs and at increasing the efficiency of wood burning stoves and charcoal producing kilns to reduce net carbon dioxide emissions.
- Strengthening national and regional capabilities of information networking, technical assistance, and extension services to introduce viable land management practices.

GEF PROJECTS ON LAND DEGRADATION AND BIODIVERSITY

Developmental assistance activities could include:

- Landuse planning and management, on a catchment and regional basis to facilitate the integration of conservation and production-oriented management of biodiversity, in areas susceptible to land degradation.
- Development and application of integrated land management, resource monitoring and ecosystem management, in relevant institutions and local communities, improvement of management practices, institutional arrangements, policies and incentives, in sectors of agriculture, forestry and urban development and wateruse, all of which impact land degradation and through it the global environment.
- In-situ conservation of significant components of biodiversity, particularly native vegetation and forests.
- Rehabilitation of degraded land and water resources with a view to conserving ecosystems, species and genetic diversity, and with appropriate participation of the local communities.
- Measures relating to sustainable use of biological resources in degraded lands which avoid or minimise adverse impacts on biodiversity.

GEF PROJECTS ON LAND DEGRADATION AND INTERNATIONAL WATERS

- Management of watersheds which come under the jurisdiction of more than one country, with a view to promote afforestation, reforestation, sustainable management of forests, soil and water conservation.
- Strengthening regional cooperation to control sediment pollution and salt intrusion in international waters (including aquifers) and of coordinated implementation of action programmes for drainage basins and regional seas, to control pollution and to protect aquatic ecosystems.

Source: UNDP, New Delhi

8.6.4 ESTABLISHMENT OF NATIONAL DESERTIFICATION FUND (NDF)

An important element of the Convention is the means of enhancing the participatory process in the decentralised governance, to enable communities to decide, where resources should be spent. In recognition of this, Article 21 of the Convention calls for “the establishment, as appropriate, of mechanisms such as the national desertification funds, including those involving the participation of non-governmental organisations,

to channel financial resources rapidly to the main source of funding for actions at the national and local levels. The funds are envisaged as national mechanisms, which will make small grants and loans accessible to communities. They are a potentially powerful instrument that could provide a major boost to translating the participatory approach into practice and could empower local communities to advance their own initiatives through a participatory mechanism in decision making. The NDF channels funds to a Local Area Development Fund (LADF) in the most direct, simple and efficient way.

Box. 8.6. National Desertification Fund (NDF) – Key elements suggested by UNDP/UNSO

Governance/Institutional Structure

- Ensure transparency and efficiency
- Internal checks and balances
- Embody/access to special expertise

Operational Modalities

- Activities should be community driven
- Simple operational procedures
- Access should be limited to community driven projects
- Low ceilings should be adopted on grants
- Community input for resource mobilisation urged (part of the funding is borne by the communities themselves).

NDFs could support:

- Alternate livelihood systems in drought-prone areas
- Participatory technology development
- Management of common property resources
- Awareness raising
- Strengthening local coping strategies for drought
- Enhancing food security at the household level

Fund Capitalisation

- Domestic Resources: Government budget, taxes, stamps, levies, lotteries, reallocation of savings, private donations, etc.
- External sources: bi / multi-lateral grants, loans, debt conversions and swaps, endowments, foundations, etc.

Financial Structure and Mechanism Suggested of a NDF

The NDF could operate separately or as a part of an existing organisation. The scale and structure of NDF in each country will be determined by the expected amount of fund to be managed, the priorities given to NAP, the political impact of desertification and the capabilities of concerned parties. The CCD proposes that greater efficiency in fund management will be ensured if NDF are operated independent of Central Government budget and also channel directly to LADF of Local Self Governments. The possibility of NDF to be held in Trust with autonomous financial institutions can help provide fiscal independence and financial transparency for NDF and more flexibility in managing external funding.

In order to ensure this, the NDF suggests the following organisation structure:

NDF Board or Committee: The number of members of the Board or Committee can vary greatly according to the size of the country and the number of concerned rural communities. Representatives of rural communities and the civil society should be selected in light of their experience and their high qualification and personal responsibility in managing public funds.

Permanent Staff: The number of permanent staff of NDF is to be lean within a range of 5-6 persons, an Executive Director, 2-3 programme officers, in addition to administrative staff – which are equipped to co-ordinate with LADFs and for financial management. In case of utilising trustee bank/institution – the bank or the institution would perform accounting functions. This account would be reviewed periodically by a qualified independent auditors. The account and fund utilisation would be an open record for any person enquiring of it and preferably posted on web-site detailing NDF performance and activities.

Local Area Development Fund (LADF): Similar to NDF and as a local mechanism of the NDF, LADFs would be created at the local level. The Board for LADFs would also have members of the Civil Society.

NDF-LADF Linkages:

- Community participation in planning, design and implementation of development projects will be essential to NDFs and LADFs.
- NDF will encourage the formation of LADFs to include all rural communities in areas affected by desertification.
- Linkages will involve procedures adopted by NDF to certify fund proposals by LADFs. NDFs will also provide concerned rural communities by criteria and guidelines to prepare financing proposals according to principles of the Convention. Such proposals will be submitted to NDF through LADFs. NDF will receive, review and approve the proposals for LADFs.

8.6.5 OTHER SOURCES OF FUNDING

Private Sector Funding: Financial institutions and private companies. Financially profitable (and environmentally viable) projects may attract private capital from private investment funds. However all these must be scrutinised and subjected to environmental laws and regulations, that they have no adverse impacts on the environment. The most suitable is to support such livelihood options, which have minimal use or impacts on the natural resources of the area.

Funding by NGOs: Fund support by NGO organisations is vital to the success of implementation of programmes particularly at the local level.

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Chapter 9

Issues & Recommendations

Highlights of Chapter 9

This chapter explains that despite a broad set of policies, strategies, programmes and activities undertaken for conservation of land resources and sustainable development, improving the socio-economic conditions of the local communities, the problem of desertification is a major environmental and socio-economic concern in the country. The chapter attempts to analyse the gaps, constraints and shortcomings in the on-going efforts and makes recommendations for taking further action for combating desertification and for sustainable development.

Introduction

Chapter 4 has explained the extent of land degradation in the country occurring due to various factors and processes which are natural and human induced. More than half of the country's geographical area (173 mha) is under degradation of some form or other. Chapter 5 has overviewed the impacts of these on various aspects - loss of natural resources, declining quality of human life in the affected regions, socio-economic impacts and effects of hydrology, and on the global climate. Chapters 6 and 7 have explained in considerable detail the on-going efforts in the country that have been put in place for combating desertification - constitutional, policy and legal framework on the relevant areas for combating desertification. A number of programmes are also under implementation for conservation of natural resources, improvement of the socio-economic conditions of affected people, delegation of powers to local self governments, encouraging people's participation. These efforts are supported by well established R&D initiatives.

However, despite these interventions, the problem of land degradation is a major source of environmental concern in the country impacting its sustainable development. Soil erosion due to wind and water induced factors is the single major process of land degradation in the country. The national average rate of soil erosion, based on existing soil loss data, has been estimated as 16.35 t/ha/yr, yielding a total soil loss of 5.3 billion tonnes annually in the country (Prasad & Biswas, 1999). About 64% of the eroded soil comes from the Shivaliks, the Western Ghats and the north-eastern States. Of the eroded soil, nearly 30% of the total eroded soil is permanently lost to the sea. The transfer of eroded soil into reservoirs results in the reduction of the storage capacity by 1-2 % annually. The data on river valley projects on 17 medium and small reservoirs in India have shown that the rate of inflow of sediment is about 3 times compared with the design rate of reservoirs rendering their life expectancy and the hydroelectric power generation to one-third of the planned capacity (Samra & Pratap Narain, 1999). The annual water erosion rate has been estimated to range from less than 5 t/ha/yr (for dense forests, snow clad mountains and arid desert regions) to more than 80 t/ha/yr in the Shivalik Hills. The annual erosion rate in the north-eastern region (which practice shifting cultivation) show top soil losses exceeding 40 t/ha/yr (These, however, do not fall within the dryland regions of the country). The annual erosion rate in the Western Ghats and the coastal regions vary from 20 to 30 t/ha/yr and can be as high as 60 to 70% if they are under shifting cultivation. Ravines affect a land area of

approximately 3.97 mha and occur along the banks of the rivers Yamuna, Chambal, Mahi, Tapi, and Krishna, and the shifting cultivation regions affecting about 4.91 mha in the north-eastern regions.

Erosion also takes away with it every year an estimated 14 million tonnes of major nutrients such as nitrogen, phosphorus, and potassium from the country's soils. Red and lateritic soils are particularly prone to this problem. Intensive cropping has further hastened the process of nutrient removal. The eastern part of Jammu and Kashmir (AESR 1.1) is the worst affected with respect to loss of soil organic matter (SOM), besides parts of Rajasthan and Gujarat. Soil Organic Matter (SOM) is one of the key resources supporting crop productivity. However, it is a dynamic resource responding to the changing land uses and input-output ratios. It has a significant bearing on soil properties related to productivity as also erosivity. Under intensive cropping and imbalanced fertiliser application systems (relying largely on N fertilisers), Soil Organic Matter (SOM) content decline irrespective of the cropping systems and soil types.

Information is not available on whether a comprehensive and detailed exercise has been carried out by the Government on the costs (direct and indirect) of land degradation to the economy of the country. The Tata Energy Research Institute (TERI) has estimated that the economic losses due to land degradation caused by lower crop yields, and reduced reservoir capacity to be in the range of 89-232 billion rupees, a loss of 11-26% of agricultural output (TERI- GREEN India- 2047).

Thus, despite the large range and extent of programmes and activities under implementation, the problem of land degradation is severe in our country. The present chapter presents the major issues (constraints, gaps and shortcomings) concerning the problems of desertification and the recommendations for taking corrective action as appropriate for combating desertification and for sustainable development.

The following important issues require to be addressed in the context of combating desertification and for sustainable development in the country.

9.1 LAND USE PLANNING

9.1.1 National Land Use Policy: There is no policy on Land Use and Land Management *per se*. A 19-point National Land Use Policy Outline (NLUPO) was prepared by the Ministry of Agriculture in 1988 and circulated to all States. Since land is a State subject, land use policy and the supporting regulatory framework requires to be framed by States for effective implementation of land related issues.

The following issues need to be taken up with regard to land use planning with the States in the context of conservation of land and land resources:

- Preparation of legislation for land use policy since land is a State subject, on all aspects of land use planning.
- Inventory, characterisation and monitoring of natural resources, as adequate information is lacking

on characterisation of soil and water resources and climatic parameters at micro-level, which is very essential for efficient landuse planning and resource allocation.

- Development of efficient and sustainable landuse plans for each agro-ecological zone or sub-zones of the country, considering their resource base, potential productivity, risk factors, and social acceptability at micro-level. This would help in creating essential infrastructure to support the system for yield maximisation and its commercialisation without adverse impacts to ecology.
- Development/reclamation of degraded lands (including permanent and current fallows) to bring additional area under cultivation in order to meet the increasing demands of food.
- Development of institutional mechanism of people for sustainable land use.
(ICAR, 1999).

The National Land Use and Conservation Board (NLCB) located in the Ministry of Agriculture is the main Body to serve as policy planning, co-ordination and monitoring at the national level for issues concerning health and management of land resources. The creation of the National Land Use Conservation Board (NLCB) and the corresponding State Land Use Boards at the State level (SLUBS) has not created a major impact. Meetings of NLCB and the SLUBs are few and held far in between. All States were asked to prepare perspective plans for next 25 years (2025) through the SLUBs keeping in view the demands for food, fuel, fodder and industrial needs. This requires to be followed up and Plans prepared by the States require to be dove-tailed with the Central planning and specific schemes prepared for meeting food-fuel-fodder-industrial requirements.

9.1.2 LAND DEGRADATION MONITORING AND ASSESSMENT

The problem of waste and degraded lands and their management in the country is a complex and multidimensional one and requires to be taken up as a national priority. A Master Plan may be drawn to deal with the problem of degraded and wastelands. Despite the number of surveys and assessments carried out by a number of organisations in the country, there are large variations in the information on the extent of land degradation. Data available require to be made available on a uniform database. Detailed database on soil and land characteristics are essential for proper diagnosis of the various degradation aspects and amendments. Vast information and data have been collected in various scientific studies and surveys carried out by the ICAR and institutions such as the AISLUS, NBSSLUP, NRSA, CSWB, etc., forest institutions etc. For a more effective utilisation by all users - policy planners and decision makers, R&D institutions, State level implementing organisations and for preparation for short, medium and long-term strategies to combat desertification, these need to be consolidated and reconciled wherever required and a common database established. A dedicated website can be created for use of all relevant stakeholders upto the local level users such as farmers, KVKs, district level functionaries, etc. This would also help in the optimal utilisation, management and conservation of land resources in the country.

Integration of assessments on status of land degradation, desertification monitoring and assessments available within the country needs to be integrated with on-going and new programmes proposed for such efforts at the sub-regional, regional, inter-regional and global level. The proposed Mission on Land Degradation could help in identification and selection of the degraded land and integrate the above-mentioned issues in the context of preparation of Action Plan under the UNCCD as given in Annex 12.

9.1.3 FURTHER RATIONALISING AND INTEGRATION OF PROGRAMMES AND SCHEMES FOR ADDRESSING LAND DEGRADATION

(i) The Department of Land Resources under the Ministry of Rural Development has issued Common guidelines for the implementation of the programmes of DDP, DPAP and IWDP on the basis of watershed development. It is recommended that all the three programmes may be implemented under a common perspective plan to combat desertification.

(ii) The National Watershed Development Programme in Rainfed Areas, River Valley Projects & Flood Prone Rivers Programme of the Ministry of Agriculture and the three programmes of the Ministry of Rural Development may have a common platform at the national, State and district level for their monitoring and regular review.

(iii) The schemes and programmes relating to soil conservation, social forestry/afforestation, eco-conservation, eco-development, eco-restoration have a direct role to combat desertification. Area specific schemes keeping in view the gravity of the problem may also be taken up on a pilot project basis. These schemes, if necessary, may have better financial norms.

(iv) The areas contiguous to the desert areas need special attention. The development machinery for agricultural production, soil conservation, dairy and animal husbandry development, promotion of better quality seeds and fertilisers, etc., in these areas should be strengthened so that they may function as an external support to the people living in drought-prone/desert areas. These areas can also function as barriers to withhold the expansion of desert areas.

(v) From the performance of these schemes, it is generally felt that the watershed approach serves to benefit the land owners directly in the watershed area rather than the landless. The provisions in the New Guidelines to financing support the assetless person to take alternate livelihood options for self-employment, does not fully compensate the landless, in terms of equitable distribution of benefits both to land owners and landless.

(vi) Involvement of communities, panchayati raj institutions, financial institutions, private sector, NGOs, SHGs as partners at all stage of implementation of the programmes is necessary. To encourage the element of competition for effective implementation of watershed development projects through active participation of the local people, it is proposed to introduce a system of reward in recognition for best performing watershed projects/communities.

9.2 MANAGEMENT OF NATURAL RESOURCES

9.2.1 LAND RESOURCES - The major land resources namely water, forestry and other biodiversity are under severe stress as a result of land degradation. This has put severe strain on the availability of water, fuel-fodder requirements of the country's population. These are taken up in the subsequent sections. The problems of desertification have led to a progressive decline of quality of life, and associated economic security.

9.2.2 WATER RESOURCES

9.2.2.1 Meeting Water Requirements of the Country

(i) Management of Surface and Ground Water Resources

It is estimated that about 10% of the surface water is unutilised. Though water is a precious and scarce resource, its application and use efficiencies have been low. The full irrigation potential of the country has been estimated to be 113.5 mha (revised to 139.5 mha), comprising 58.5 mha from major and medium schemes, 15 mha from minor irrigation schemes and 40 mha (revised to 66 mha) from ground water exploitation. India's irrigation potential has increased from 22.6 mha in 1951 to about 90 mha at the end of 1995-96. Against this, the utilisation of irrigation potential at the end of 1995 was 78.5 mha. It is estimated that even after achieving the full irrigation potential, nearly 50% (75 mha) of the total cultivated area of 145 mha will remain rainfed. In addition, only 30% of the annual sustainable groundwater potential is utilised.

In addition, the country also loses a large percentage of irrigated water due to faulty irrigation practices. Most irrigation projects are operating at a low efficiency in the range of 30-40%, thereby losing 60-70% of the irrigation water during conveyance (ICAR, 1999). In another estimate by TERI, about 45% of irrigation water seeps through unlined field channels and another 15% is in excess of what is required (TERI: GREEN India, 2047). Large areas in Uttar Pradesh, Gujarat, Punjab, etc have become degraded due to faulty irrigation practices.

Severe problems of water logging have been observed in the IGNP. Similar problems have been observed in the arid stretches of Haryana State. In the coastal alluvial plains of Kutchh and Saurashtra regions of Gujarat, high pumping of potable groundwater along the sea has resulted in intrusion of saline water into freshwater aquifers. In many instances, although groundwater is available in wells constructed in village land, people are denied access to its use due to social conflicts or social order.

(ii) Issues of Pricing of Water

The industry also uses water equally wastefully: water-use efficiency in the country compares unfavourably with not only the developed world but also with several developing countries. Supplying power at grossly subsidised rates have encouraged farmers to sink more and more wells and to pump increasingly larger

quantities of water from them. Efforts to regulate the withdrawals of water have not been successful; imposing credit restrictions has not worked because rich farmers are known to use diesel-powered pumps where water tables are high. (TERI: GREEN India, 2047). Pricing of water is another issue, which leads to its misuse. The issue also needs to be studied in terms of man-hours lost in a day for simply collecting water - both in urban and rural areas - these costs need to be estimated in the overall pricing of water.

Tube wells are mainly affordable to the rich farmers. The boring of a large number of tubewells, mainly by rich farmers, has resulted in the steady decline in the level of groundwater in all major water deficient States. The poor and marginal farmers and the landless are the first to be affected in times of severe conditions of drought. Subsidy provided to the farmers, for energy such as electricity and diesel for their benefit, has led to increase in the number of tube wells in an area, resulting in over abstraction of groundwater and its decline in such areas. The increase in the number of tube wells and cheap energy has led to over abstraction of groundwater, leading to serious problems of salinity, in certain regions causing wastelands and affecting productivity in the region.

(iii) Inter-State Sharing of River Water and the Issue of Mega Hydel Projects

Inter-State sharing of river water has been contentious and with conflicts. However, the co-basin States are arriving at agreements on sharing of waters of the basin through mutual negotiations. In some cases, the Tribunals constituted under Inter-State Water Disputes Act have also given awards on sharing of inter-State river waters. Mega Hydel projects have been successful in India. Large dams such as the Bhakra, Nagarjuna Sagar, Hirakud and the Mettur dams have helped in development of the people of the country. These projects have contributed in making India self-sufficient in food grain production, besides providing benefits of drinking water and hydro-electric energy to the growing population. The Sardar Sarovar project has been built in the drought-affected areas of Gujarat.

(iv) Maintenance of a Minimal Flow

Water management should also include environmental issues such as minimal flow of water throughout the year at various stages of the river/rivulet and also indication of maximum flow, to achieve recharge of groundwater, to be managed by underground and surface storage. Minimal flow of river water also helps its regeneration after mixing with domestic effluents.

(v) Maintenance of Water Quality

Prevention of pollution addressed in the Policy on Abatement of Pollution, 1992 requires to be given special attention for safeguarding the quality of water available. Three sectors need to be looked at simultaneously, since these eventually affect the river water quality; viz., (i) domestic sanitation specially in urban areas, (ii) industrial effluents-treatment and encouraging recycle and reuse, and (iii) agricultural pollution due to excessive use of chemical fertilisers and pesticides.

9.2.2.2 Use of Cost-effecting Water Harvesting Systems to Meet Country's Requirements

(i) Revival of Traditional Water Harvesting Systems

India has a rich history of use of traditional systems of water harvesting in almost all the States. Conservation of both surface and groundwater has been an integral part of India for many centuries. In fact, ponds and tanks represent an important community resource for drinking water in rural India even today. However, many of these traditional practices were abandoned during and after the colonial rule. India also has high levels of ground water, which have supplemented the surface waters especially during lean season as well as in regions, which are rainfed. The storage of even the scanty rainfall, through simple as well as extensive types of traditional water harvesting of surface and ground water have been the important sources of water in arid regions such as Rajasthan and Gujarat. These practices have often saved the drought-affected regions from problems of water famine. The serious problems of water shortages in many parts of the country, particularly during drought years, which could at least partially cope with the problem to meet the needs of cattle, and irrigation are being largely attributed to the discontinued use of traditional water harvesting practices. There is a dire need for revival of these traditional water harvesting systems.

The programmes of the Government such as the DDP, DPAP and the integrated watershed projects have an element for harvesting the traditional water systems and involvement of the local communities in the maintenance. Despite the on-going programmes of the government at the Central and State level, the serious drought situation that is recurring for the past two years in the drought-prone areas of the country has thrown up a number of issues, which would require to be taken up further.

An important aspect of the success of these traditional water harvesting systems has been the involvement of the community at large. The community in many villages regulated water harvesting, distribution, and use. Before the onset of monsoon, the catchment of the tanks would be cleaned of all waste and rubbish. Similarly desiltation of tanks, ponds, cleaning of *baoris*, *nadis*, *kundis*, etc., and their repairs would be carried out by the entire community, in an annual or biannual operation just prior to the monsoon.

While the importance of providing safe drinking water is not questioned, the problem of water shortages and effects of drought can be minimized by integration of drinking water schemes with cost effective water harvesting technologies and practices.

RECOMMENDATION ON WATER RESOURCE CONSERVATION

In order to meet the country's water needs, the following issues need to be taken up:

- (i) Identify the water scarcity areas – both natural as well as artificial scarcity.
- (ii) Measures for conservation of water in the irrigation projects.
- (iii) Integrate cost effective and traditional technologies for water harvesting both in rural as well as in

urban areas (roof-top water harvesting). This would involve revival of traditional water harvesting systems practised in our country. In urban areas, this would entail the mandatory introduction of roof-top water harvesting in buildings, especially those which under planning/ construction. Roof-top water harvesting should be made an essential component of building bye-laws in all States.

- (iv) Measures to address the problem of falling water tables and groundwater pollution.
- (v) Water and energy pricing and subsidies for the rural sector.

Integrated planning should take into account the following:

- Water resources viz. rainfall, groundwater and surface water.
- Watershed and small schemes in all sizes of projects ranging from watershed to big project on the main river should receive priority.
- Sectoral demand to be integrated in a dynamic way in order to allow the variability of demand in the next 50 years when the population and the use of water in economic activities are likely to be stabilised. This should also cater priorities within the basin from one watershed to the other.

9.2.3 ENVIRONMENTAL ISSUES

Poor Implementation of Environmental Laws:

Despite providing the enabling environment for taking corrective action where necessary for resources conservation through the promulgation of a number of laws on environmental issues, their implementation remains poor. This is a major drawback in protection of the environment and the natural resources of the country. For example, pollution of land and water remains one of the major problems of concern for the deterioration of environmental quality. Untreated/partially treated effluents are discharged in the surface waters –such as rivers and streams, which affect their quality.

The problem of pollution is severely aggravated in water bodies, which are not perennial and their capacity of regeneration is poor. Dumping of soils and toxic wastes onto land affects their productivity and can lead to leaching of chemicals into the ground water severely contaminating such sources. Industrial activity in already fragile ecosystems play havoc and lead to further deterioration of land. For example in Gujarat which is situated in the hot arid region with water shortages and frequent droughts, is a base to a number of chemical processing units, petrochemicals, etc., which in short period of operation have led to further depletion and degradation of the natural resources.

9.2.4 UNSUSTAINABLE AGRICULTURAL PRACTICES

Due to a number unsustainable practices that were followed for meeting 'targets in food production', lack of awareness amongst the farmers in regard to unsustainable practices such as excessive use of fertilisers, pesticides, frequent cropping patterns, inappropriate technologies, or choice of crops/ plants, etc, the food

production capacity has plateaued. In some situations it is actually declining for the following reasons:

- decreasing organic matter.
- decline in soil fertility.
- excessive use of fertilizers.
- increasing salinity.
- falling water tables.
- pest management problems.
- build up of weed, pathogens, etc.

(Source: FAO, 2000)

Box. 9.1 Ten years of work, undone in one year

Surendranagar is an arid district in Gujarat with all its nine blocks declared as drought prone. An NGO started working in that district from 1984 through programmes aimed at regenerating land and water resources through people's institutions. In one particular cluster of three villages, they invested more than Rs. 50 lakhs for rainwater harvesting structures and for afforestation of wastelands. The depleting water table and fastly eroding wasteland showed all signs of revival. Then, in 1994, a giant chemical company moved in to set up a factory that manufactured hazardous chemicals that required huge quantity of water. The percolation tank constructed by the villages and the NGO came handy for the industry. Almost the entire water source in the three villages was utilised by the factory. To add to the woes, the factory had poor effluent and waste disposal system. The factory dumped wastes outside its premises, which soon found its way into the village ponds and seeped into their wells, that provided water to the people and cattle. In 1995, when people were taken sick and the cattle started dying, a litigation was filed in the High Court of Gujarat and the factory was shut and the premises sealed.

Source: Development Support Centre, Ahmedabad, Gujarat.

Addressing Unsustainable Agricultural Practices

The Indian Council for Agricultural Research (ICAR), which is the premier institution for development and promotion of agriculture-related technologies in the country, has the following specific recommendations for adoption of sustainable agricultural practices:

- Regulating the use of fertilisers:
 - Improvement in fertiliser use efficiency by 8-10% over the current level of 30-40%.
 - Enhance the contribution of organic and bio-fertilisers to meet one-third of the plant-nutrient needs and development of appropriate technologies for improving their efficacy and integrated nutrient systems.
 - Creating and enhancing awareness amongst farmers on the adverse impacts of excess use of fertilisers.
 - Integrated technologies for management of nutrients, tillage and weeds in major cropping systems.
- Development of technologies for efficient and safer utilisation of poor quality waters for crop production, as the share of water allocation to agriculture is expected to be reduced by 10-15%.
- Increasing cropping intensity by about 20-30% over the current level, to increase the total food grain production. Enhance use of inter-cropping and sequential cropping systems in irrigated areas.
- Irrigation system management:

- Enhancement of water productivity by about 10% of the current level.
- Cost-effective drainage technology for saline and water-logged soils in order to reduce the cost of reclamation by 25%.
- Development of location-specific watershed models in rainfed areas to enhance the average productivity from 0.8 t/ha to 2.0 t/ha.
- Development of integrated farming systems, specific to different farming situations prevailing in the country.
- Multi-purpose tree components for different agricultural production systems to be identified to augment the supply of fodder, fuel, industrial wood and timber in rural areas.
- Development of appropriate methodologies for improvement in agromet-services and their effective use in mitigation of drought.

(Singh, GB, 1999)

9.3 MEETING FOOD-FUEL-FODDER REQUIREMENTS

9.3.1 Food Security

9.3.1.1 Increasing Food Production

India acquired self-sufficiency in food grain production through the ‘Green Revolution’ of the sixties and the seventies, which enabled the country to make a quantum jump in food grain production from 52 million tonnes in 1952 to 130 million tonnes in 1980. The maximum food production in India has been recorded as 202.54 million tonnes in 1999 (MOA). The country has been able to meet the challenges of food security for nearly 3 decades and even now the country is food surplus. On the basis of the current trends in the consumption pattern, it has been estimated that the total requirement of food grains is likely to be around 245 million tonnes by year by the year 2006-2007.

By considering various factors such as population growth rate, diminishing per capita of land and water resources, and increasing land degradation problems, it is estimated that India will be required to produce an additional 5-6 million tonnes of food grains annually in the 21st century. This is expected to lead to tremendous pressure on soil resources along with competitive demand for it from industrialisation and urbanisation (DAC, MOA, 2000). The availability of additional land has not been appreciable during the last 40 years (Fig. 9.1), with almost the entire country’s arable land having been utilised for agricultural production. In fact, some of the good arable land has been converted to non-agricultural uses.

In order to sustain the country’s food production, there are three options that can be taken up concurrently:

- (I) Address the issues as mentioned in the cropped areas of the country for restoration/ increase of the production of the arable land.
- (II) Develop new technologies/ varieties which could boost food production to meet the country’s demand.
- (III) Identify additional land which are marginal/degraded for bringing into agriculture supported by appropriate technologies for land reclamation, crop production and participation of all stakeholders in the process.

To further harness the growth and potential of agriculture, development of agro-based industries will need to receive special attention. Agro-based industries are not only labour -intensive and contribute to increased value-addition, they expand the market for agricultural commodities both domestically and externally. They can have very positive effects on the terms of trade for agriculture and thereby on the incentive for more rapid

agricultural growth. The agro-processing industry in India can grow through provision of adequate credit, quality transport, storage and marketing facilities (Planning Commission, 1997).

9.3.1.2. Marketing and Distribution of Food

The appropriate mechanisms of marketing and distribution of food would require to be reviewed and strengthened can ensure a better food security, particularly to the poor, especially in times of severe drought.

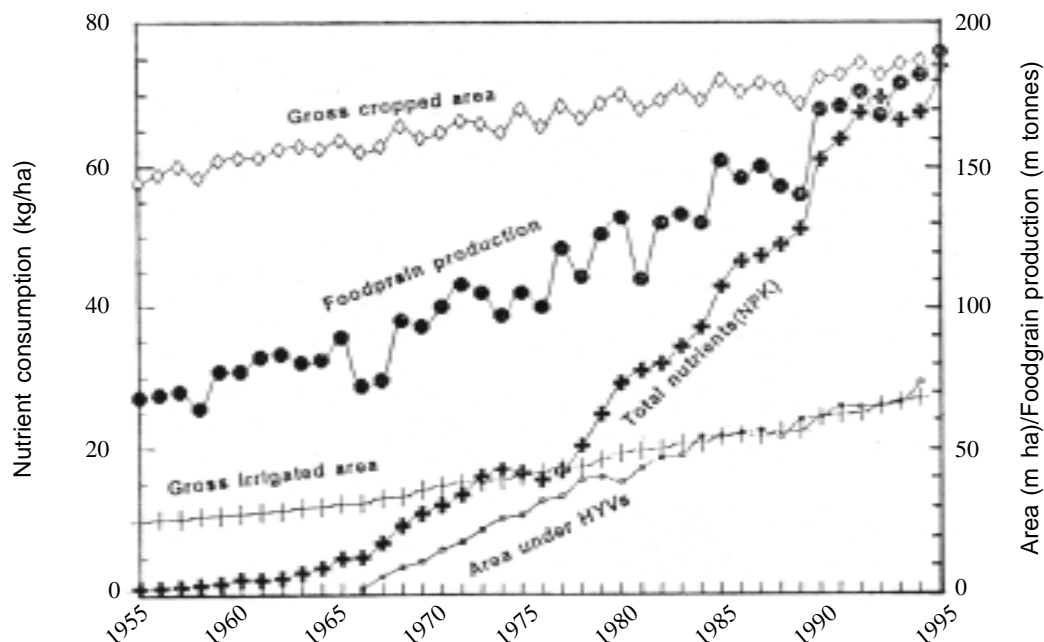


Fig.1. Growth of major production factors and food grain production in India (Source : FAI 1997 as quoted in Singh, G.B., 1999)

9.3.2 Meeting Fuel-Fodder Requirements

9.3.2.1. Easing Pressure on Forest Resources of the Country to Meet Fuel-Fodder Requirements

The quality of Indian forests has declined over the years. Crown density is an index of determining the thickness of forest in a region and therefore the success of conservation of the forest. The percentage of forests with a good crown density is low. TERI has estimated that the current annual growth of forests is only 88 million cubic metres whereas potentially, it could be as high as 139-235 million metres. Two main factors for this decline in forests is the overexploitation of forest wealth and the diversion of forest land for other uses.

(i) Consumption of Wood from Forests

Consumption of wood (timber and fuelwood) in India is considerably (4 to 5 times) higher than what can sustainably be removed from the forests. Much of the rural energy for cooking comes from collection of fuelwood from forests. In 1990, the excess removal of fuel wood (mostly unrecorded) was estimated to be about 250 million cu.m with an expected increase to 310 million cu.m by 2000 (NFAP, MOEF, 1999). This contributes to the overall deterioration of the quality, stocking condition and productivity of the forest ultimately leading to deforestation and degradation. The gap between consumption of fuelwood and what the forests can sustainably supply has increased from 106 million cubic metres to 207 million cubic metres. (TERI, GREEN India 2047)

(ii) Grazing in Forest Land

Forest land are an important source of grazing and fodder in the absence of adequate pasture land and a

viable policy of fodder development. It is estimated that over 270 million livestock consisting of over 50% of India's livestock graze in the forests (NFAP, 1999). These include traditional ethnic sedentary village livestock and migratory animals herded by ethnic grazers. Additionally grazers collect an estimated 175 to 200 million tonnes of green fodder annually. This results in overgrazing and over-extraction of green fodder, leading to forest degradation through damages to regeneration and compaction of soil. A sample survey of FSI estimates that impact of grazing affects 78% of the country's forests, of which 18% suffers high incidence and 31% medium incidence. Grazing occurs even in protected areas. In another survey, 67% of the national parks and 83% of the wildlife sanctuaries surveyed reported grazing incidence.

(iii) Meeting Fuel-Fodder Requirements

Several estimates have been made over the past five decades the availability (supply) and requirements (nutritional demand) of feeds and fodder for the livestock and the actual deficits. The limitation in all these estimates is the virtual impossibility of assessing green and dry fodder availability from the so called permanent pastures, chance grazing on fallows and margins, grazing on CPRs and the seasonal vegetation available all over the country during the monsoons (MOA, 1996). It is estimated that during 1993, the country faced a deficit of 570 million tonnes green fodder, 276 million dry fodder. The 1995 combined availability of green fodder from permanent pastures, other grazing lands, agricultural lands and forests was estimated at 434 million tonnes, whereas the minimum requirement was estimated to be 882 million tonnes. The big gap has resulted in unlimited and unrestricted grazing in forest lands. (SOE, 1995). In 1993, the Ministry of Environment and Forests constituted a Policy Advisory Group on grazing and livestock management. The Group in its report identified a large gap between demand and supply of animal feed and cited the National Agriculture Commission (NCA 1976) which projected deficit of 16.2 and 19.8 million tonnes of dry and green fodder respectively, for the year 2000 (Table 9.1).

Table 9.1: Availability of Feed and Fodder as of 1993 and Projections for 2000 AD

Feedstuff	Current Availability (million tonnes)	Current Requirement (in million of tonnes)	Deficiency (%)	Availability 2000 AD (in million tonnes)	Requirements In 2000 AD (in million tonnes)	Deficiency (%)
Straws	398.88	31.0	31.0	523.61	632.61	17.3
Green Fodder	573.50	744.73	23.0	573.50	830.12	31.0
Concentrates	41.98	79.40	47.1	88.05	46.18	47.6

Source: Draft Report of the Policy Advisory Group on Integrated Grazing Policy - MOEF, 1993 quoted in MOA, 1996.

However, both cattle and buffalo population has already outstripped the projected population for the year 2000. The Group observed that India with only 4 percent of the world's land mass, has 15 percent of the world's cattle population, half the number being buffaloes, 15 percent of the goat and 40 percent of the sheep population. This large animal population cannot be provided sustenance by forests alone. It suggested that the problem would have to be tackled in a coordinated manner by all the line departments *viz.*, Agriculture, Animal Husbandry, Forests, Soil Conservation, Rural Development, Irrigation, Revenue, etc. without which no policy for restoring country's ecological balance, which is the ultimate objective of a grazing policy, would be possible.

(iv) Policy Issues on Forest Conservation

The National Forest Policy suffers from a major weakness that it has been developed solely within the

forestry sector, without being closely linked to related sectors. As a result, the NFP tends to be ignored by other sectors, which fail to notice the benefits from forestry contributing to their objectives. However, available information points out that failure to achieve some of the policy objectives have been due mainly to ineffective implementation rather than inadequacies of the policy *per se* (Government of India 1999b). The National Forestry Action Programme (NFAP) is a comprehensive plan of action for the healthy management of forests in the country and for reforestation of the recommended 33% of the country's geographical area under forests. The Programme presently does not have committed funds.

(v) Policy Issues on Meeting Fuel-Fodder Requirements

Presently, there is no comprehensive policy on fuel-fodder needs and how they are to be met. There is as yet no national grazing policy *per se*. In absence of clear guidelines, laws or policy, the issue is being dealt with in a sectoral manner by the forestry, agriculture, rural development ministries using their existing programmes and perspectives. The issue is being under by the MOEF vis-à-vis the National (Forest) Policy, 1988. Two policies had been drafted which have a direct bearing in addressing fuel and fodder requirements and management. These are: (i) Draft grazing and livestock management policy, 1994 and (ii) Draft National Policy for Common Property Resource Lands (CPRLs). The issues that were to be addressed under these are briefly explained below:

Draft Grazing and Livestock Management Policy, 1994

- Each state should give attention to the breeding policies and programmes, particularly around forest areas within the state so that non-descript cattle can be eliminated and people provided with productive cattle or buffalo which will not only be stall fed but also provide economic returns to the owners.
- Forest areas and forest fringes have, by and large, remained outside milk-sheds largely because of problems of logistics. Consequently, the people around forests have not felt the need to rear productive animals resulting in proliferation of non-descript cattle. Removal of restrictions on grazing in forests has also contributed to the proliferation of decrepit cattle.
- The Department of Animal Husbandry will have to provide marketing facilities to milk producers in these areas to enable the villagers to rear economically productive animals. In addition, people in dry desert and otherwise environmentally fragile areas need to be provided with alternative environment-friendly employment.
- In arid and semi-arid regions, large blocks of land away from human habitations should be developed as grass reserves for higher production and the hay preserved in Fodder Banks. This is particularly required for chronically drought-prone States like Rajasthan, Gujarat and Haryana.
- Development of alternative avenues of fodder production will be achieved by promoting silvi-pasture system in the degraded forests with people's participation.

Draft National Policy for Common Property Resource Lands (CPRLs)

The policy seeks to provide support to the people and their production systems through restoration, protection, regeneration, upkeep and development of CPRLs. The Policy, *inter alia*, states the following.

- Privatisation of CPRLs should be stopped, and exceptions may be made only on very special and exceptional considerations. Government departments and public requirements of land from CPRLs should be carefully vetted. The encroachments on the CPRLs should be demarcated on ground, described in records and necessary measures taken to remove the encroachments. The State should have adequate

legal authority to prevail upon the *panchayats* and other local bodies for protection of CPRLs. The village communities/user groups should be involved in planning, regeneration and management of CPRLs, including distribution of benefits.

- It should be clearly understood that the poorer sections of the community have special claim on the produce of CPRLs.
- Voluntary agencies and NGOs with established credibility and commitment might be involved as interface between government and local community for the management and development of the CPRLs. They should, however, act as facilitators rather than implementers.

<p>Box. 9.2 CONSIDERATION FOR CPRs:</p> <ul style="list-style-type: none"> • What constitutes membership of the community/group. • What constitutes agreement/unanimity/consensus or majority. • On what basis the right will apply over time. • How the rights are transmitted between generations. • Where controls reside: committee, elders, leaders. • How compliance with agreed rules are to be judged. • How to correct for departures from rules. • How to settle disputes.
<p>GROUND RULES FOR PROMOTING CPR MANAGEMENT & FUNCTIONING:</p> <ul style="list-style-type: none"> • Livelihood security, sharing basis, basic needs are met. • Access equity and conflict resolution, equitable use of resources. • Mode of production – sharing common knowledge, extend cooperation, share labour, non-hierarchical. • Resource conservation, social sanctions on excessive use. • Ecological stability. <p>Source: G.K.Kadekodi, et.al. Regeneration of Degraded and Wasteland, Institute of Economic Growth, New Delhi as part of UNDP/MOEF Funded Project.</p>

Most CPRs suffer from what is called “the tragedy of the commons”. CPRs can be effectively managed to contribute fully to economic growth and development and help alleviate poverty, unemployment and ecological degradation. Social responsibility of the livelihood systems subsisting on the common property resources (CPRs) must conform to norms of sustainability, lest every investment in improving the fodder availability from the CPRs (as long as they continue as Open Access Regimes) would be enabling the uncontrolled increase in animal numbers. Investment in CPRs for their regeneration should form part of a national plan to contain numbers, demographic and livestock, all addressing the primary issues of sustainability-ecological balance-environmental safety (Government of India 1996).

The maintenance of CPRs should ultimately be the responsibility of the villagers/Panchayats. The 73rd Amendment should be used to effect these changes. People’s participation with the help of VAs can play a vital role in meeting the pasture/tree/fodder needs of the local communities.

It is desirable to look at all the issues explained in the sections above, falling within the purview of management of forest-agriculture-rural development, grazing, fodder and fuel wood requirements, and long-term management CPRS under one single comprehensive policy.

(vi) Management Issues related to Forestry

- Legal procedures of establishment has not been completed for some 60% of national parks and 90% of the sanctuaries.
- 57% of national parks and 27% of wildlife sanctuaries have no management plans. Wherever the management plans have been prepared, their implementation does not meet the minimum standard.
- PAs have not been integrated through forested corridors or establishing complementary multiple use areas. In many cases PAs remain as isolated islands. There is also a lack of integration of PAs with surrounding areas or buffers.
- Conflicts between forest administrators and people in villages located in surrounding areas or in buffers – damages to crops, cattle killed by carnivores, diseases from livestock to wild animals, prohibition of use of forest resources, etc.
- Insufficient funds, infrastructure.
- Lack of awareness and training.
- As the availability of sun in dryland areas is almost throughout the year, programmes for installation of solar photo voltaic street lights, solar cookers, solar power generation should be taken upon a large scale. Smokeless 'Chullahs' may also be promoted to save scarce availability of fuelwood.
- Valuing forest productivity not only in terms of timber and fuelwood, but also biomass such as fodder, soil cover, stabilisation of ecosystems, social and economic productivity and stability, etc.
- Afforestation of land in lieu of the forest land taken up for developmental programmes and projects is not vigorously pursued or monitored.

9.3.3 Meeting Rural Energy Needs

As indicated in Chapter 6, sub-section 6.7.6, there is considerable scope for expanding the energy potential from renewable energy sources. Table 9.2. provides an eye-view of the potential and achievements of production of energy from renewable sources.

Table. 9.2: Potential and Achievements of Renewable Energy sources

Source/ Systems	Approximate Potential	Achievement (as of October 1997)
Biogas Plants (Numbers)	12 million	2.57 million
Improved Chulhas (Stoves) (Numbers)	120 million	26 million
Biomass	17,000 MW	105 MW
Solar Photovoltaic	20 MW/sq.m	28 MW/sq.m
Solar Thermal Power Systems	35 MW/sq.m	4.36 lakh sq.m
Wind Power	20,000 MW	925 MW
Small Hydro Power	10,000 MW	151 MW
Power from Municipal Wastes	1700 MW	3.75 MW

Source: Ninth Plan Document, Planning Commission.

In order to ensure efficient use of these energy sources in an environmentally friendly manner, the following measures can be taken:

- Creating necessary institutional mechanisms for R&D, demand development through market mechanisms, mandatory use of established technologies, amendment of Electricity Act for absorption of non-conventional power into the grid, creation of infrastructure for repair, maintenance, etc.
- Reviewing administrative and other bottlenecks.
- Giving thrust on co-generation programmes in industries to meet their power needs and enable them to sell the surplus power to utilities.

(9th Plan Document, Planning Commission).

9.4 PARTICIPATORY APPROACH TO LADPS

9.4.1 Decentralised Governance

With the PR Act, 1992, a number of sectoral programmes which were integrated into the watershed-based programmes were transferred to the panchayats. These however did not get constituted immediately. Elections were delayed in many States. The panchayati institutions in many States do not have the necessary infrastructure, training, manpower and suitable support systems for effective implementation of those programmes. The role of NGOs, CBOs, VAs and extension services provided by the KVKs, DRDAs is vital to further strengthen the system of decentralised governance. This issue needs to be looked by all the relevant ministries in an integrated manner.

The potential of all farm and non-farm activities for the creation of adequate livelihood income and employment opportunities in each watershed requires to be fully explored and utilised. The watershed development programmes would gradually shift from Centre to State or even local bodies and ultimately the people themselves should plan, implement and maintain them. There should a shift from NRM based livelihood programmes to non-NRM based alternate livelihood projects and programmes in the degraded regions.

9.4.2 Institutional Framework at the Local Level

The implementation and success of watershed programmes to ensure long-term sustainability of the watershed development process can be possible only through ownership of the programmes by the local communities and by the institutions at the district / local level. The most important amongst these are the Watershed Committees, DFOs, DRDAs, Gram Panchayats, Local Self-Help Groups and NGOs. The Project Implementing Agencies (PIAs) play an extremely crucial role in strengthening the process of decentralisation.

9.4.3 Role of NGOs, CBOs and VAs

- NGOs, CBOs and VAs can be an effective interface between Government and the farmer/villagers/local communities by creating awareness among individual farmers, communities and organisations regarding the disastrous consequences of deforestation, degradation of land, water and soil fertility, etc and its link with poverty, and economic production systems.
- Access appropriate technologies and create effective information systems.
- Assist the farmers in using fallow lands and field bunds for selecting and growing suitable plants, trees for meeting local needs.
- Undertake directly projects of afforestation and land development with a view to developing viable units.
- Accessing micro-credits for application of technologies or seed money for catalysing community driven projects.

Table 9.3. Stakeholders and their possible participation in the NAP process

Name of Stakeholder	Description	Role
Internal Stakeholders Farmers	Peasant/pastoralists commercial who reside and depend on the affected lands	*Very useful in problem identification and could also provide solutions to some of the problems. *Have vast experience and indigenous technology. *Owners of the process.
Governments	Represented in the NAP process by selected sector, ministries/ departments	*Coordinator of all NAP activities through focal ministry/ department *Assigns responsibilities to stakeholders *Ensures obligations under the Convention are met. *Mobilisation of masses
NGOs/CBOs	Locally or internationally based NGOs involved in many environmental, developmental and other activities in different parts of the country	*Promote popular participation *Compliment governments effort *Could provide funding for NAP activities
Academia	Include research institutions, state agricultural universities	*Assist in carrying out research in various areas including technology development and alternative technology *Training
Business/private sector	Business and industry community	*Funding of some NAP activities

Source: Kaul, RN, 2001

Promote people's committees at the local level to lend support to various activities to be implemented at the local level. However, identification of NGOs should be done carefully. NGOs with proven record alone should be involved in the implementation of the programmes. Direct funding without knowledge and recommendation of the local authorities should not be taken up in the LADPs.

9.5 SOCIAL SECTOR AND COMMUNITY BASED PROGRAMMES

9.5.1 Human Development Issues - Integration of Human Development with Sustainable Development

Socio-economic development, human development and sustainable development are three issues, which are inextricably inter-linked. Land degradation, human development and poverty and environmental conservation therefore need to be addressed in a concerted manner in order to achieve sustainable development. Chapters 6 and 7 have explained in considerable detail the extent and magnitude of the on-going efforts of the Government of India in the implementation of a large number of programmes, schemes and measures in the social sector and in human resource development. India fares poorly in UNDP Human Development Report (2000), where India is ranked 115th rank amongst 162 nations compared on a set of human development parameters such as life expectancy, adult literacy, population below poverty line, population without safe access to water, etc. Some of these are given in Table 9.4:

Table 9.4: Socio-economic and Human Development Status in India

GDP (US\$ billion, 1998)	4.30
GDP per Capita (US \$, 1999)	2248
Life Expectancy (in years, 1999)	62.9
Adult Literacy (in % above 15, 1999)	56.5
Population below Poverty Line	35%

Population without Safe Access to Water	12%
Infant Mortality Rate (per 1000 births, 1998)	70
Seats in Parliament held by Women (as % of total) (1998)	8.9
Female Professional & Technical Workers (as % of Total) (1998)	20.5

Source: Human Development Report, 2000 and 2001, UNDP

A number of States - Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh and Orissa (BIMARU + Orissa) are considerably lagging behind other States in the country, in terms of human development, due to the poor socio-economic and human resource development in these regions. For example, the provisional results of the Census 2001 released by the Registrar-General and Census Commissioner indicate that, as of March 1, 2001, although the overall literacy rate has increased from 52.21% in 1991 to 65.38% in 2001, there are large differences in these between States. The most literate State in the country namely, Kerala (92.92% literacy), has the lowest population growth (9.42%). The sex ratio is also good in Kerala (male: female = 1000: 1,058). The lowest literacy rate is in Bihar (47.53%). The most populous States are Uttar Pradesh (16.17%) and Bihar (8.07%). The BIMARU States constitute 44% of the total population in the country as in 1996, and are expected to contribute to 55% of the population growth between 1996 and 2010. As a result, the problem of poverty is acute in many parts of these States. The population growth is expected to be high (> 2.0) in the BIMARU States and is expected to stabilise well beyond year 2050 in some of these. In contrast, the four southern States of Andhra Pradesh, Karnataka, Tamil Nadu and Kerala are expected to show a combined population growth of just 14% during the same period and are showing declining population. The 9th Plan document states that improvement to social and demographic indicators cannot be achieved except through significant changes in social attitudes and empowerment of women is particularly crucial. Improvements in social infrastructure - in health and education - done by States such as Kerala helped achieve remarkable increase in human development. The Population Policy, 2000 of the GOI has been prepared keeping these issues and the necessary steps involved to achieving population stability. Human development of most backward regions, and empowerment of women is especially identified as a crucial element in the improvement of socio-economic conditions.

The severe problem of population pressures is also inter-linked with land degradation. **The issues of achieving population stability, improving the socio-economic conditions in the most degraded/backward areas of the country is of utmost importance, particularly addressing the BIMARU States and Orissa, in the context of addressing the problem of desertification.**

9.5.2 Issues regarding Gender Empowerment

- Involvement of women in LADPs.
- Increase women's access to financial resources through micro-credits for projects for income generating activities linked to decentralised control.
- Facilitation of easy access to land resources through reviewing land laws and customs affecting women's access to land and ownership.
- Involvement of women in decision making in LADPs.
- Provision of skills to women: Equipping women in the necessary skills to implement programmes and projects of LADPs.
- Ensuring the one-third representation of women in local self governments as envisaged by the 73rd Constitutional Amendment.

9.5.3 Other Issues Pertaining to Community & Social Sector

Programme in the social sector can be broadly divided into following areas :

- Programmes for social awareness and security and empowerment of women and weaker sections of the society.
- Programmes for infrastructure development and employment generation.
- Programmes on health, nutrition, sanitation and safe drinking water;
- Programme on literacy and preschool education and adult literacy.

Box 9.3 Empowering Rural Women with Vocational Skills - An Experience in Bihar

Dr.C.Prasad, Ex. DDG, ICAR and President, VARDAN, New Delhi, and member of RIOD-INDIA

Bihar is one of the States in the country richly endowed with resources, but unfortunately in terms of human and economic development is lagging behind most other States today. By nature and culture, women are closest to the environment - land, water, plants, animals, and forests. However, in Bihar and elsewhere wrong traditions and social stigma and customs such as the caste system has affected the poorer and weaker sections of the society and particularly their women. The 'upper caste' women in Bihar also remained confined to their homes as a symbol of social status and prestige of not mixing with male members and with 'lower caste'. VARDAN, an NGO, took up the issue of sensitizing the women on development. It was the view that the economic issues would be met with less resistance than social and cultural ones. Initial attempts for organising village meetings met with only partial success. There were intense rivalry and differences from one 'Tola' (hamlet) to another. VARDAN focused on younger women and girls who were desirous of getting training in vocational skills such as tailoring. A Tailoring Training -cum-Production Centre (TTPC) was begun in a doctor's premises free of cost. Tuition fees was a nominal amount. However, as the place was centralised, the teacher was motivated to come for higher earnings from the group of students. In this manner about 150 girls were trained and some have started earning by making local garments besides doing stitching for their families.

In due course it was realised that there were a number of women in the villages who were qualified and trained in a number of vocational skills but social customs have prevented them from coming out to work. Slowly they began to join in the courses and in teaching technical skills. Then came an advanced entrepreneurship development course for garment making, village crafts and food processing, supported by NABARD, Patna. The number of women aspiring to join the course was far greater than was possible. The family members were happy with their vocational pre-occupations. Women and girls thus trained formed the VARDAN Mahila Sangh with their own office bearers and have besides economic activities have initiated some social activities as well.

The success of the courses were given prominence in a function and a few women of the Village Panchayat shared the dais with the DM, district Saran, Chapra, Bihar and the CGM, NABARD, Patna - the first time in their tradition ridden social custom. This was a great moment for them and the excitement was shared by their husbands, fathers and other members of the family. The women trainees were also taken to Patna for exposure. As a result of all these efforts, there is a tremendous demand for such training courses and the women restless for such self-employment opportunities, have formed four Self-Help-Groups (SHGs) with an average of 15 members each with their own office-bearers. More such groups are in the offing. This has created sufficient interest for the *Kshetriya Gramin Bank* (Regional Village Bank) for empowerment of women. Bringing change in a society is a continuous and dynamic process which need innovative means for bringing in development and progress. VARDAN is presently engaged in started a Training-cum-Production Centre in food processing with value addition to the local food materials.

In spite of their common target groups and objectives, these programmes are being implemented by different Ministries/Departments. This in many cases results in not only duplication of efforts but also weaken the effects and results at the ground level. All the existing programmes be reviewed and merged where common objectives exit. This will strengthen efforts for LADPS in dryland areas. There is multiplication of implementing agencies at the field level lacking proper coordination for better results. Programmes for health, nutrition and drinking water may be implemented and monitored taking them as one sector. Similarly other programmes such as literacy, and pre-school education, infrastructure, development, and employment generation, and programme on social security and employment may need to be implemented in a similar manner. Programmes on welfare and development of women and children may be better addressed if they are placed under one umbrella, i.e., Department of Women and Child Development.

Income Generation Schemes

- Different agencies have been involved for promotion of income generation programmes. Single Window System should be adopted for providing capacity development and loaning facilities to SHGS, etc.
- There should be a clear cut coordination between the programmes on capacity building and income generation.
- Role of financial institutions such as NABARD should be strengthened.
- Market facilities for small income generation groups/individuals should be strengthened.
- Alternate livelihood schemes: towards non-farm, non-NRM based livelihood systems to take the pressure off the natural resources and to prevent further degradation of the land.

9.6 RECOMMENDATIONS FOR CAPACITY BUILDING

Different Ministries/Departments are implementing schemes/specific training programmes for quality improvement and capacity building of stakeholders. Training Institutes at the National and State levels have been established for conducting training programmes by various Ministries/Departments. Training Institutes are having permanent infrastructure and training facilities. According to reports, in many cases the facilities created are not being fully utilised. Training programmes relating to watershed management, soil and water conservation, agriculture sector and forestry especially for LADP may be dovetailed for adopting a common approach for sustainable development. ICAR, NIRD, MANAGE, etc. can play a lead role in this regard.

Training/Capacity building of SHGs and Communities is essential requirement of LADPs. Different strategies are being adopted for their capacity building and empowerment under different programmes say Watershed Development, Indira Mahila Yojana (IMY), Integrated Child Development Services (ICDS), and CAPART. In some cases there is duplication of efforts which are counter productive. There should be convergence of efforts. For this uniform training modules may be developed.

(ii) ICDS training already has provision for joint training of ICDS functionaries with AMMs and other para-medical staff. Similar approach may be adopted in other programmes/sectors.

(iii) The training institutes like DIETs, NIPCCD, SIRDs are equally relevant for organisation of training programmes in respect of all functionaries and stakeholders in the social sector and community development.. The facilities at these institutes may be upgraded and they should become centres of excellence for quality training and capacity building in the social; sectors for LADPs.

(iv) Special training packages to handle problems of malnutrition and health in drought-prone and desert

areas may be developed. In this regard, experiences of NIN, NIPCCD, CARE and NIHFW are required to be integrated for food security.

(vi) The ICDS Training Programme contains a provision that about 30% of the training syllabus will cover the State specific or area specific needs. The State Governments concerned may include specific training needs of LADPs in dryland areas.

(vii) Concept of SHGs for various programmes to be covered under LADPs has become almost universal. Development of specific capacity building packages for SHGs for LADPs may be considered.

The schemes of capacity building are directly related to the schemes of income generation for poverty alleviation. Different agencies have been involved for promotion of income generation programmes. The income generation schemes of Ministry of Rural Development, Department of Women & Child Development and Ministry of Social Justice and Empowerment have common target groups so far as SC/ST are concerned. Single Window System should be adopted for providing capacity development and loaning facilities to SHGs, etc. Self-Help Groups and Non-Government Organisations have been identified as the common base for implementing income generation schemes for poverty eradication. There should be clear cut coordination between the programmes on capacity building and income generation. Employment generation schemes also help in income generation but are being implemented as independent schemes. Role of financial institutions like NABARD should be strengthened. Market facilities for small income generation groups/ individuals should be strengthened.

9.7 INFORMATION DISSEMINATION

(i) The monitoring, evaluation, mass communication, mass education and extension facilities developed by various Ministries like Agriculture, Rural Development, Health & Family Welfare, Education, Women and Child Development should be dove-tailed for dissemination of information in respect of all schemes being covered under LADPS. Similarly information must be viable on issues of desertification, factors causing desertification, assessments and monitoring, programmes and schemes, policy structure, etc should available for all users based on need and type of utility.

(ii) There is a need for a comprehensive plan for compilation, coordination and sharing of information with respect to soil, land use and degraded lands.

(iii) A common set of monitoring Proforma and if possible a web site dedicated for covering all these issues may be developed for the use of all relevant stakeholders.

(iv) Specific workshops both of technical and administrative nature may be organised for dissemination of information on LADPs.

(v) List of networks and websites of all institutions involved in all the relevant areas impacting desertification and sustainable development requires to be prepared and disseminated.

Role of IT Sector for Sustainable Development

The IT Sector is a great tool, and if properly utilised, could improve the life of millions. Though the internet revolution has gripped the country and India has emerged as a world leader in Information Technology, the fruits of this revolution are yet to reach a vast section of the population. With a density of only 0.1% of internet access, a long road lies ahead before Internet access reaches each and every village of the country.

Access by rural population is possible through a multitude of technologies ranging from fibre optics network, VSAT to cable TV, to cover the entire length and breadth of the country.

9.8 SHORT-TERM, MEDIUM-TERM AND LONG-TERM TECHNOLOGICAL INTERVENTIONS FOR COMBATING DESERTIFICATION IN THE COUNTRY

The approach to planning for implementation of development programs is crucial and central to reach the goal of sustainable restoration of degraded lands. The Working Group-2 constituted for NAP formulation on "Sustainable Land Use Practices for Combating Desertification" has recommended a set of short-term (five years), medium-term (10 years) and long-term (20 years) interventions for combating desertification as part of strategic planning (Singh *et al*/2000). The suggested approach however, must integrate to ongoing efforts. Besides, the three types of interventions may start simultaneously depending upon specific situations and available resources. For instance, the field boundary shelter belt plantation in arid and semi-arid regions though a medium-term measures, must be initiated in the beginning itself to derive fullest benefit from short-term measures. These strategies are discussed and presented at Annex 10. And briefly explained below:

Short-term measures the core object of the short-term measures is capacity building of farmers through the diffusion of low cost implementable technologies which address the problem on short-term basis with a view to provide immediate benefit to farmers without need for high monetary inputs yet leading to tangible benefits from improved crop productivity, thus resulting in indigenous capacity building. These short-term measures are particularly meant to ensure utilisation of the *in situ* conserved moisture integrated with improved crop management for enhancing the crop yield.

Medium-term measures once the farmers begin to realize the benefits of adopting technologies through short-term measures, they can better understand the goals for control of desertification and respond to participate in the adoption of medium and long-term measures. Integrated watershed management involving farmer participatory technology development (PTD) with a farming system perspective is central to medium-term measures.

Long-term measures besides generation of large-scale surface and ground water resources, amelioration of wastelands, which have gone out of cultivation, should receive special attention in such interventions. Reclamation of shallow and medium deep ravines, salt affected lands, waterlogged areas, and stabilisation of sand dunes and sandy hummocky terrain's should be the target areas for long-term plans.

The strategy may also incorporate the recommendations of species selection made by the Arid Forest Research Institute for Combating Desertification, in the context of the UNCCD.

9.9 DROUGHT MANAGEMENT AND MITIGATION

- There is presently no policy on drought *per se* and has been addressed in a sectoral manner by individual ministries.
- Drought Contingency Plans are yet to be prepared at the Central and State levels and the coordination mechanisms between the Centre and the States prone to drought are yet to be put in operation.
- There is a need to strengthen the national climatological and hydrological capabilities to ensure early establishment of early warning systems and to suggest measures for strengthening drought preparedness and management including drought contingency plan at local, national and regional levels.
- Drought Contingency Plans should consider drought mitigation measures which are immediate following the drought and long-term mitigation measures (CAZRI, 2000):

Immediate Measures Include:

- Assuring the availability of drinking water and food grains.
- Fodder depots.
- Food for work programme.
- Cattle Camps.
- Relief works.

Long-Term Preventive Measures:

- Early Warning Systems to enable planners, farmers to plan according to the severity and areas affected by drought.
- Adoption of appropriate technologies which are drought resistant.
- Timely availability of resources such as credit, fertilisers, pesticides, and power for increasing crop production.
- Improvement in communication and transport system.
- Introduction of cottage industries and other alternatives for employment generation.
- Crop and livestock insurance.
- Remunerative prices for produce in good years, which cushion the onslaught of drought in lean periods.
- Reasonable buffer stock of food grains and fodder and their effective transportation to the drought affected areas to prevent famine like conditions.
- Rational utilisation of Common Property Resources (CPRs) such as water and grazing lands.
- Afforestation/pasture land development: Permanent pastures and CPRs to be revegetated with grass species such as *Lasirus indicus*, *Cenchrus ciliaris*, and *Lenchrus setigrus* and top feed species such as *Prosopis cineraria*, *Acacia Senegal*, *Tecomella undulata*. Such silvi-pastoral systems survive annual droughts and provide rich fodder particularly in the arid regions.
- Efficient irrigation technologies such as sprinkler systems and drip systems if the economy permits such an adoption.
- Revival of traditional water harvesting systems.
- Integrated watershed management in those watersheds not covered under DDP, DPAP.
- Optimising livestock population to carry capacity to limit pressures on the natural resources.
- Education, awareness and training to combat desertification and drought situation.
- Use of remote sensing for drought preparedness: This includes identification of sites for sitting rainwater structures by ISRO/DOS using satellite data and use of decision support systems such as GIS for wasteland development plans and for optimising facility/infrastructure. Use of remote sensing applications for groundwater prospects. Mapping of desertification and its severity should be done on micro-level like Tehsil or Block on a micro-level (1:4000) rather than district level (1:50,000) at least in the severely affected/drought prone districts.
- Conservation of Flora and Fauna in the PAs: These include identification of all national, sanctuaries which are in the drought prone areas and prepare specific contingency plans.
- Conservation of gene pool of endangered species and varieties of both flora and fauna I of dryland biodiversity to ensure species survival through creation of gene banks.

9.10 USE OF TRADITIONAL KNOWLEDGE

- (i) The Convention has placed a great emphasis on use of traditional knowledge and practices. The

Committee on Science and technology (CST), CCD has in fact devoted considerable attention to this issue. The Convention has particularly identified pastoralists and nomadic population as one of the resources user groups whose participation is vital to NAP. It also calls for attention to the need to foster a greater use of the knowledge, know-how and practices of local people, particularly traditional pastoral methods. Special programmes/schemes for this require to be drawn up.

- (ii) Use of traditional technologies in conservation of natural resources, agriculture, water harvesting, drought management, livestock management, etc., and their integration with modern technologies.
- (iii) Creation of a centralised system of traditional knowledge available in the country on the above-mentioned areas.

9.11 INTEGRATION OF REGIONAL, SUB-REGIONAL ACTION PROGRAMMES AND OTHER ACTIVITIES OF THE UNCCD WITH NAP

All activities being taken up in NAP must be integrated with the activities being taken up under the UNCCD at the regional (Asia), Sub-regional (yet to be identified so far), and inter-regional scale (desertification monitoring and assessment and use of EWS). Projects on synergies amongst Conventions require to be undertaken. National organisations involved in land degradation assessments such as NBSSLUP, AISLUS, NRSA and in drought early warning such as the IMD, NMRWFC, also need to be actively involved in participation in activities of CST under the UNCCD and other scientific international bodies and organisations relevant to desertification. They also need to be involved in programmes under TPNs for Asia (particularly TPN-1, TPN-4 and TPN-5) as climate, weather, water availability and drought are closely interlinked. Studies on impacts of the El-Nino/ENSO phenomena on weather conditions in different regions of the country need to be carried out for preparation of regional contingency plans for sustained agricultural productivity. In this regard, long-term and decadal trends to century scale variability in meteorological parameters in the context of global warming should also be considered under new initiatives for combating desertification. Other activities such as use of early warning systems (EWS) and participation in inter-regional forums such as the Afro-Asia Forum that deal with EWS, and in activities at the global scale such as the LADA/MA, etc.

A Roster of experts from cross-cutting disciplines should be constituted to take advice, and in creating awareness, information dissemination and for preparation of activities and projects on combating desertification. Participation by the experts in all activities not only at the national but also at the international level is essential for taking effective action in a concerted manner.

9.12 ESTABLISHING A MONITORING MECHANISM ON DESERTIFICATION

There is an inherent and urgent need for establishing a clear monitoring mechanism of the impacts of all these programmes and schemes in terms of improving the livelihood status and socio-economic conditions of the people in the degraded/vulnerable areas and regions. The existing monitoring mechanism for programme implementation is heavily dependent on status of expenditure made in various programmes and schemes. Fund utilisation as the main parameter for monitoring progress of schemes has inherent drawbacks in understanding the impacts in achieving the objectives. Besides, schemes involving environment have an inherent drawback in demonstrating “environmental benefits” which is a much more difficult task than showing “economic or social benefits”, as the former may take as much as 25-50 years for eco-restoration of degraded lands, whereas the economic and social benefits could be shorter and quite often at the expense of

environmental benefits. The existing mechanism of monitoring utilisation of funds, therefore, requires to be dovetailed with a new set of benchmarks and indicators, which are uniform, verifiable and followed across the affected regions of the country and also specific to the problem area/region. Therefore the programme implementation would involve not only monitoring of expenditure but also would be supported by representative set of indicators, which reflect the bio-physical, socio-economic and environmental improvements in the affected regions. The evaluation mechanism being followed by the Ministry of Agriculture for its watershed programmes and the efforts of the Working Group set up under the Planning Commission for further rationalising of programmes and projects of MOA, MORD and the MOEF is a good approach and can be built upon using a set of impact and implementation indicators.

In addition, modern evaluation and monitoring techniques and tools using scientific methodologies should be used by all the key organisations and particularly by the Planning Commission. This should include study of 'business-as-usual (BAU) scenario in comparison with various other scenarios that could effect the most positive changes in the shortest possible time.

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Chapter 10

Formulation of the National Action Programme (NAP)

Highlights of Chapter 10

This chapter analyses the status of fulfilment of our obligations in terms of meeting the objectives of the Convention -to combat desertification and to improve the socio-economic and living conditions of the people in the affected regions. The Chapter also discusses the financial constraints in addressing the on-going efforts for sustainable development and for combating desertification. The chapter suggests a number of options for seeking external assistance under the UNCCD for combating desertification in the country. The specific issues on which we need to take decisions for formulation of the National Action Programme are also submitted.

10.1 Preparation of a National Action Programme

As explained in Chapter 1, India as an affected developing country became a signatory to the UN Convention to Combat Desertification (UNCCD). The Ministry of Environment and Forests (MOEF) represented the Government of India in the decisions of the UNCED in June 1992 for adoption of the UNCCD. The MOEF, on behalf of the GOI also actively participated in the INCD process and is the National Focal Point for the implementation of the UNCCD in the country. In the light of Part-II Article 5 of the UNCCD, one of the important obligations of the affected developing country Parties is to prepare a National Action Programme (NAP) to combat desertification and mitigate the effects of drought in the country.

10.1.1 Establishment of the National Steering Committee

The MOEF as the National Focal Point (NFP) is responsible for the formulation and implementation of the National Action Programme for combating desertification and mitigating the effects of drought in the country. In July 1999, the MOEF constituted a High-Power Inter-Sectoral National Steering Committee (NSC) with members representing the major ministries/ departments and organisations of the Government, key Departments of the State Governments, R&D Institutions, NGOS, Planning Commission and other representative organisations, including UNDP (Annex- 11). This NSC is to be redesignated as the National Policy & Coordination Committee (NPCC) to Combat Desertification.

10.1.2 Terms of Reference of the National Steering Committee

During the first meeting of the NSC held in August 1999, the specific Terms of Reference (TOR) of the NSC, drawn from the Convention document for the formulation and implementation of the NAP, were identified and approved. These are given in Box 10.1.

10.1.3. Constitution of Working Groups

The National Steering Committee also decided to constitute four Working Groups (WGs) thereunder, which was entrusted to deliberate on the following areas:

- (i) Desertification Monitoring and Assessment and Early Warning Systems.
- (ii) Sustainable Land Use Practices for Combating Desertification.
- (iii) Local Area Development Programmes (LADPs)
- (iv) Policy and Institutional Framework

Box 10.1 Terms of Reference of the National Steering Committee (NSC) for NAP:

“The NAP shall inter-alia:

- (i) Incorporate long –term strategies to combat desertification and mitigate the effects of drought.
- (ii) Give particular attention to the implementation of preventive measures for land that are not yet degraded or which are only slightly degraded.
- (iii) Enhance national climatological, meteorological, and hydrological capabilities and the means to provide for drought early warning, and strengthen drought preparedness and management, including drought contingency plans at the local, national, sub-regional and regional basis.
- (iv) Establish and/or strengthen food security systems, including storage and marketing, particularly in rural areas, and establish programmes, aimed at eradicating poverty and ensuring food scarcity and through sustainable management of natural resources and energy resources and agricultural practices.
- (v) Promote policies and strengthen institutional frameworks which develop cooperation between various stakeholders – donor community, government at all levels, local populations and community groups and facilitate access by local population to appropriate information and technology.
- (vi) Provide for effective participation at the local, national and regional levels of non-governmental organisations, local populations, and resource users, at all levels of implementation and review of the NAP.
- (vii) Be sufficient flexible at the local level to cope with different socio-economic, biological and geo-physical conditions.
- (viii) Identify and analyse constraints, needs, gaps affecting sustainable landuse and development.
- (ix) Establish pertinent, quantifiable and readily verifiable benchmarks and indicators (both implementation and impact indicators) to ensure the assessment and evaluation of NAP.
- (x) Identify and prioritise requirements for financial assistance and technical cooperation.
- (xi) The existing successful action programmes in the sub-regional and regional action programmes would also be utilised to the extent possible in the preparation of NAP.
- (xii) Programmes under NAP would be updated through a continuing participatory process.”

Table 10.1: Constitution of the Four Working Groups under the NSC

Working Group (WG)	Subject	Chairperson	Member-Secretary
1	Desertification Monitoring & Assessment & EWS	Deputy Director-General, ICAR	Director, CAZRI
2	Sustainable Land Use Practices	Deputy Director-General, ICAR	Director, CRIDA
3	Local Area Development Programmes (LADPs)	Joint Secretary, MORD	Joint Secretary, Dept. of Women & Child Development, Min. of Human Resource Development
4 &	Policy & Institutional Framework	Joint Secretary, MOEF	Director, National Afforestation & Ecodevelopment Board (NAEB), MOEF

The details of the Working Groups and their TOR are given in Annex.12.

10.2 Consultative Process for the Preparation of NAP

The Four Working Groups constituted under the NSC met for deliberations on their Terms of Reference. Meetings were held in Jodhpur, New Delhi and the Reports of the Working Groups were submitted to the Ministry during 1999 (WG#1) - 2000 (WG# 2, 3 and 4). Initial comments on the NAP were also received from individual organisations that had been identified to be associated with the NAP process. Simultaneously the Ministry engaged a consultant for the preparation of the draft National Action Programme, based on information provided by the WGs as well as information already existing with the various ministries, institutions and organisations. The consultant submitted the final draft on 25th January 2001.

The Ministry of Environment and Forests circulated the draft NAP along with the reports of the 4 WGs to all members of the NSC and the WGs during October-November 2000. Apart from those listed in the NSC and in the WGs, it was decided to address all States falling within the dryland regions (as per Thorthwaite classification). The Chief Secretaries of these States and the Departments of Agriculture, Environment and Forests, Water Resources/Irrigation, Animal Husbandry and Rural Development were particularly informed and their comments solicited on the reports of the 4 WGs, the draft NAP and the NAP process. All organisations were particularly requested to highlight the success stories on various areas, gaps/ constraints/ failures in the existing policy/programmes and functioning of the existing structure involved in issues on desertification and drought, and vision 2020/perspective plans for addressing issues relating to meeting food-fuel-fodder requirements in their States. Based on the draft reports submitted by the consultant, the reports of the working groups, reports and documents of the GOI Departments and Ministries, etc. the Ministry prepared its first draft NAP in February 2001. The draft Report presented the Status of Desertification in the country and explains the issues (priorities, constraints, gaps) governing desertification in the context of the existing national framework of policy, programmes and the institutional and legislative framework for preparation of the National Action Programme for Combating Desertification in the country.

Documents consulted included:

1. Reports of the Working Groups.
2. Draft NAP Report prepared by the consultant.
3. GOI publications, reports, documents.
4. Reports of the Planning Commission.
5. Scientific Publications/Journals.
6. UNCCD documents.
6. Reports of International Organisations and Donor Agencies.
7. Reports/ Documents of Non-Governmental Organisations.
8. Miscellaneous reports, documents and news items on relevant issues.

In addition, views /suggestions received separately from the following organisations were considered:

1. Ministry of Agriculture –Department of Agriculture & Cooperation
2. Ministry of Agriculture- Department of Animal Husbandry
3. Ministry of Rural Development
4. Ministry of Non-Conventional Energy Sources
5. Department of Drinking Water Supply

6. Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad
7. National Research Centre for Agroforestry (NRCAF), Jhansi
8. Indian Council of Agricultural Research (ICAR)
9. Arid Forest Research Institute (AFRI), Jodhpur
10. India Meteorological Department, Pune
11. All India Soil and Landuse Survey, New Delhi
12. Youth for Action, Hyderabad (RIOD)
13. State Environment & Forest Department, Government of Haryana
14. State Irrigation Department, Government of Karnataka
15. State Environment & Forests Department, Madhya Pradesh
16. Central Arid Zone Research Institute (CAZRI), Jodhpur
17. National Institute for Rural Development (NIRD), Hyderabad
18. National Remote Sensing Agency (NRSA), Hyderabad
20. Space Applications Centre (SAC), Department of Space, Ahmedabad.
21. Planning Commission
22. Development Support Centre, Ahmedabad.
23. Central Soil Salinity Research Institute (CSSRI), Karnal
24. Society for Prevention of Wasteland Development (SPWD), New Delhi
25. Ministry of Social Justice and Empowerment.
26. Government of Orissa

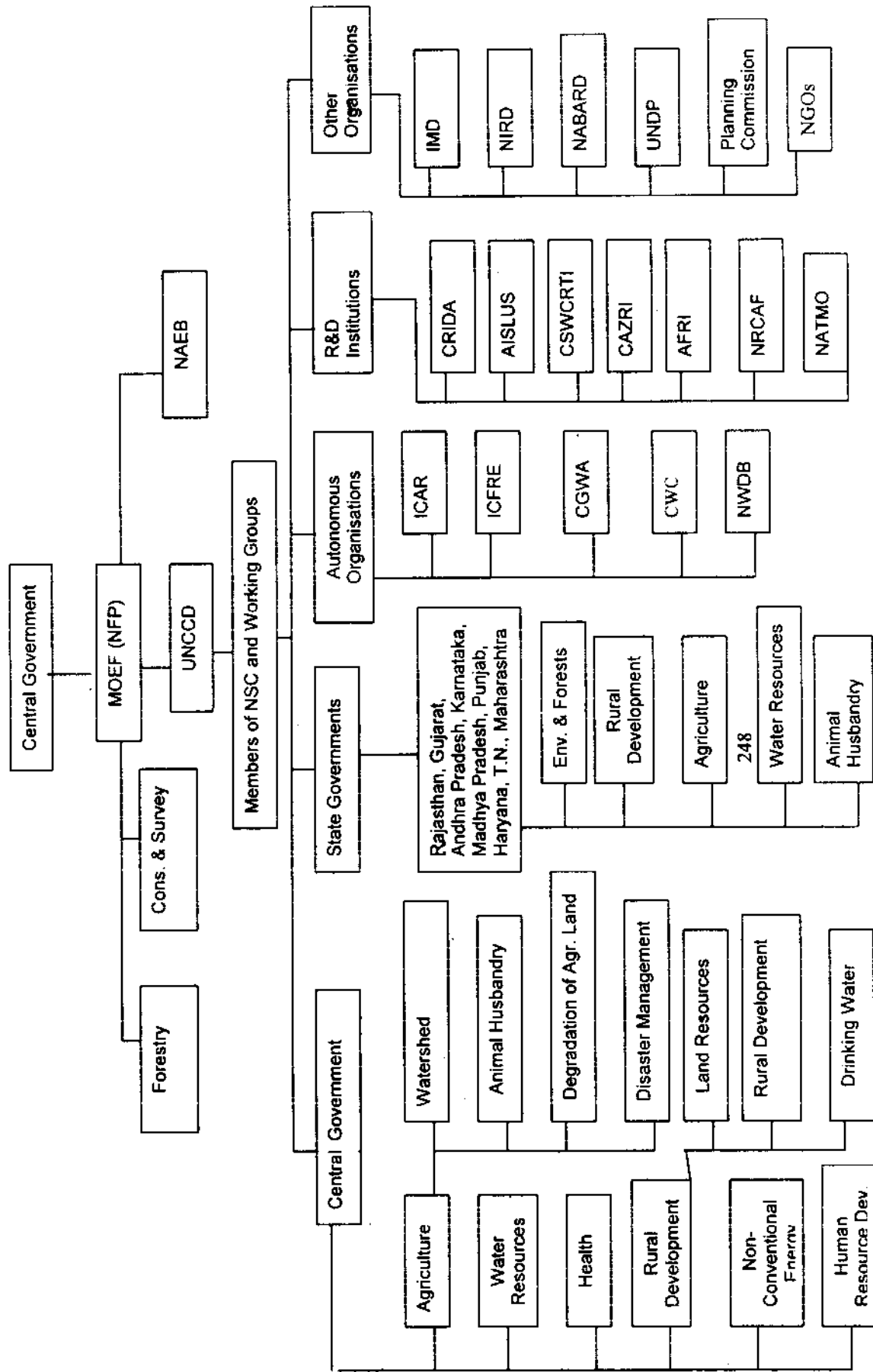
The Ministry of Environment and Forests also had informal meetings and discussions with a number of donor countries, organisations and agencies. The details of the consultations done for the formulation of the NAP is summarised in Table 10.2 and in the organograms presented in Figs. 10.1 and 10.2.

Table 10.2: Consultative Process Followed for the Preparation of the National Action Programme

Date/Period	Activity
July 1999	Constitution of the National Steering Committee under the MOEF
August 1999	First Meeting of the NSC -Decisions on NSC's TOR and for constitution of 4 Working Groups (WGs) on 4 broad focal areas
September 1999	Constitution of 4 WGs
Sept.-April 2000	Meetings of the 4 WGs
December 1999	Submission of the Report of the WG#1 (Desertification Monitoring & Assessment)
February 2000	Engaging of Consultant for preparation of the National Report and the draft National Action Programme
April 2000	Submission of the draft National Report by the Consultant
April 2000	Submission of draft National Report to the UNCCD Secretariat
April 2000	Submission of the Report of WG#2 (Sustainable Land Use Practices)
May 2000	Revision of National Report based on comments received from the key Ministries
June 2000	Submission of the Final National Report to the CCD Sect.
June 2000	Submission of the First Draft National Action Programme by the Consultant
June 2000	Submission of the Report of WG#3 (Local Area Development Programme)
August 2000	Submission of WG#4 (Policy & Institutional Framework)
September 2000	Second draft National Action Programme by the Consultant

Fig. 10.1 Organisation Chart for Formulation of the National Action Programme (NAP) to Combat Desertification in the Country

(* The Chart depicts the relation of programmes of various organisations in relation to the UNCCD)

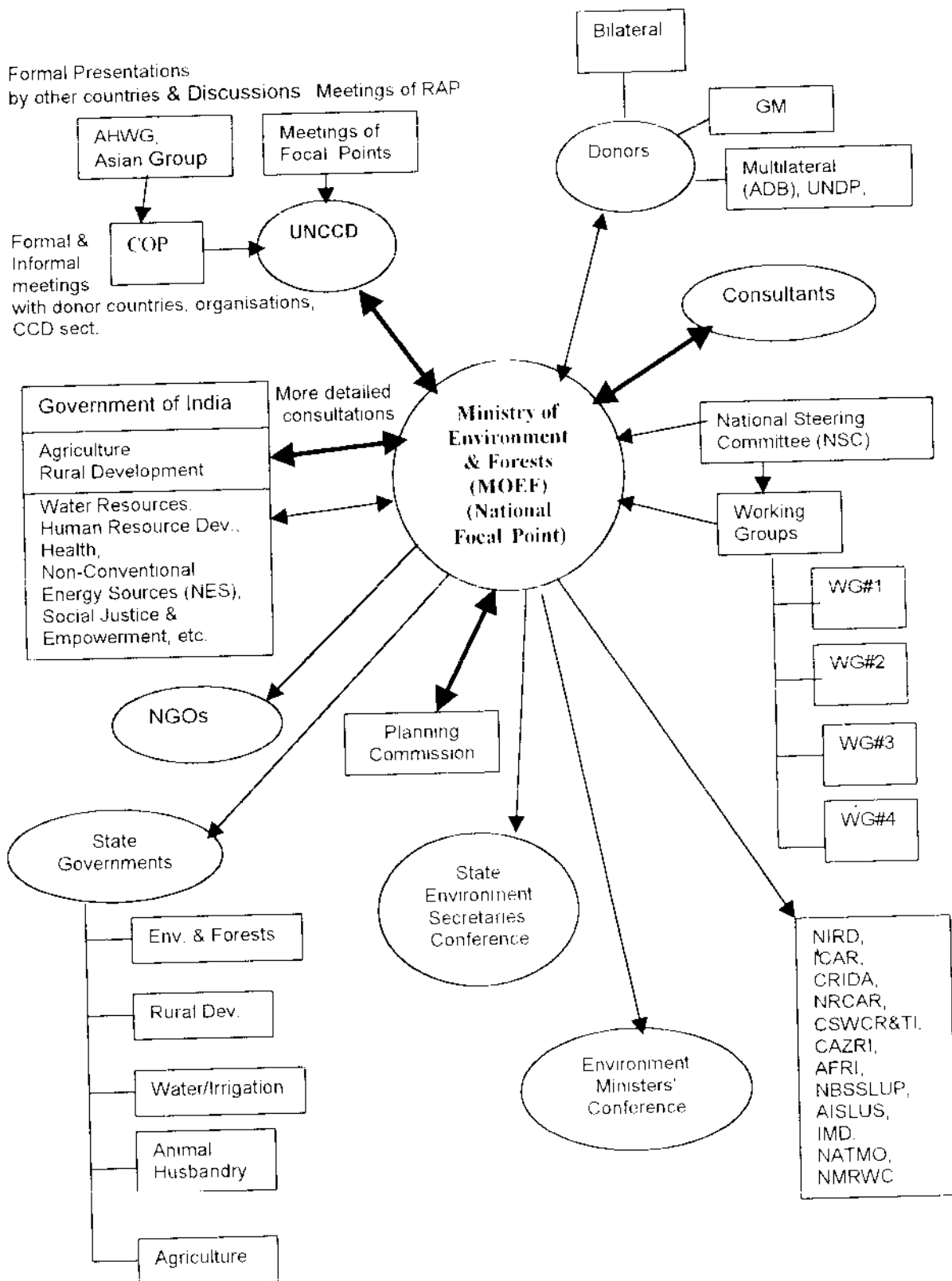


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Oct.-Nov. 2000	Circulation of the draft National Action Programme to the members of the NSC, members of the WGs and State Governments
October, 2000	Updation of the National report for submission to COP-4
November 2000	Formal and informal discussions of NAP at the Asian Focal Points Meeting, Bangkok.
November 2000	Printing of National Report for circulation & Discussion in COP-4.
December 2000	Discussion of the National reports at the Ad-Hoc Working Group at the Fourth Conference of the Parties (COP-4) to the UNCCD at Bonn during December 11-22, 2000. Informal and Formal discussions with donors, Asia Group Representatives and the CCD Sect.
Dec.2000-Jan. 2001	Receipt of comments from various organisations
January 2001	Discussion of NAP in the conference of the Environment Secretaries (Jan 4-5, 2001)
January 17, 2001	Third draft National Action Programme by the Consultant
January 2001	Presentation and Discussion on NAP during the Environment Ministers' Conference
January 25, 2001	Fourth and Final Draft of the draft National Action Programme by the Consultant
February 20, 2001	First Draft of the National Action Programme (Status Report) by the MOEF based on the draft reports of the consultant, reports of WGs, discussions/comments from Central and State Govts., reports/publications/documents of the UNCCD, etc.
February 2001	Internal Discussion of the first draft of MOEF
March 1, 2001	Second draft NAP (Status) Report prepared by MOEF
March 18, 2001	Discussion of the MOEF's revision of NAP with Core Group of Ministries and the Planning Commission and In-principle approval of the Background Report on Status of Desertification in the Country (Volume-I) . Decision for preparation of an Action Plan under NAP (Volume-II). Decision to engage a Consultant for its preparation.
April -May 2001	Process of selection of Consultant and for obtaining fund assistance.
May-June, 2001	Selection of a Consultant for preparation of the National Action Programme (Volume-II).
June15- August 1, 2001	Preparation of a National Action Programme (Volume-II) by Consultant.
August, 2001	Circulation of the 2-volume NAP to the members of the National Steering Committee.
August, 2001	Meeting of National Steering Committee for approval/finalisation of the 2-volume NAP.
October 2001*	Submission of NAP to the UNCCD and to COP-5.
Dec. 2001*	Two Regional Workshops (Northern-Western and Southern) to prepare activities/projects from NAP Report.
January 2002*	Round Table Conference with donors.

* Proposed schedule of activities

Fig. 10.2 ORGANOGRAM DEPICTING THE CONSULTATIVE PROCESS FOLLOWED FOR NAP FORMULATION



10.3 Status of Fulfilment of Obligations under the UNCCD

The major obligations of the affected Developing Country Parties under the Convention are recapitulated in Box. 10.1.

Box 10.2	Part II - Article 5 of the UNCCD: Obligations of the Affected Developing Country Parties
<ul style="list-style-type: none"> • Give due priority to (i) combating desertification & (ii) mitigating the effects of drought. • Establish strategies & priorities within the framework of sustainable development. • Address underlying causes of desertification and particularly to the socio-economic factors contributing to the desertification process. • Promote awareness and facilitate the participation of local populations, particularly the women and youth, non-governmental organisations, in efforts to combat desertification and mitigate the effects of drought. • Provide an enabling environment by strengthening the relevant existing legislation, enacting new laws, where they do not exist, and establish long-term policies and action programmes. 	

Part III Section 1, Articles 9 & 10 National Action Programmes

All affected developing country Parties shall prepare a National Action Programme, utilising and building to the extent possible, on existing relevant plans and programmes and sub-regional and regional action programmes, as the central element of strategy to combat desertification and drought.

Table 10.3 : Status of Fulfilment of Obligations of the UNCCD in Our National Framework

Obligations under the UNCCD	Status as Reflected in our National Framework					
	Policy	Legal	Strategy	Programmes	Institution	R&D
1. Give due priority to (i) combating desertification & (ii) mitigating the effects of drought.	✓	✓	✓	✓	✓	✓
2. Establish strategies & priorities within the framework of sustainable development.	✓	✓	✓	✓	✓	✓
3. Address underlying causes of desertification and particularly to the socio-economic factors contributing to the desertification process.	✓	✓	✓	✓	✓	✓
4. Promote awareness & facilitate the participation of local populations, particularly the women and youth, non-governmental organisations, in efforts to combat desertification & mitigate the effects of drought.	✓	✓	✓	✓	✓	✓
5. Provide an enabling environment by strengthening the relevant existing legislation,	✓	✓	✓	✓	✓	✓

enacting new laws, where they do not exist, and establish long-term policies and action programmes.

6. All affected developing country Parties shall prepare a National Action Programme, utilising and building to the extent possible, on existing relevant plans and programmes and sub-regional and regional action programmes, as the central element of strategy to combat desertification and drought.
- The current exercise is towards fulfilling this obligation.

Expl. Note: ✓-Existing, x - Not existing

The underlying issue here is that major thrust of our policies, strategies and Plan programmes, institutional and legal framework are in tune with the objectives of the UNCCD.

10.4 Priority Areas for National Action Programme

The issues presented in Chapters 6, 7, 8 and 9 are extremely relevant in the context of the identifying and prioritising measures and activities that could constitute a National Action Programme for combating desertification and mitigating the effects of drought in the country. Chapter 6 summarises the major policies, programmes and regulatory and institutional framework, which are in place for combating desertification in the country. Chapter 7 has presented the new initiatives that have been taken during the past decade for sustainable development of the country. Chapter 8 provides an overview of the UNCCD activities at the regional, sub-regional and global level that are in progress or planned and would require to be dovetailed with the NAP process. Chapter 9 has summarised in brief the issues (gaps/constraints/shortcomings) that are identified from these chapters in the policy, planning, programmes and the recommendations for activities that require to be taken in the context of combating desertification in the country. Based on these, an attempt has been made to identify the strengths and weaknesses in these efforts - policy, plans, programmes and the regulatory and institutional framework and R&D. These are given in tables 10.4 and 10.5.

Table 10.4: Analysis of Strengths and Weaknesses in Our National Framework for Combating Desertification

Obligations under the UNCCD	Analysis of Strengths & Weaknesses					
	Policy	Legal	Strategy	Programmes	Institution	R&D
1. Give due priority to (i) combating desertification & (ii) mitigating the effects of drought.	++	+	++	+++	+++	+++
	+		+	+++	+	++
2. Establish strategies & priorities within the framework of sustainable development.	+		++	++	+	+

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3. Address underlying causes of desertification and particularly to the socio-economic factors contributing to the desertification process.	++	++	+++	+++	++	++
4. Promote awareness & facilitate the participation of local populations, particularly the women and youth, non-governmental organisations, in efforts to combat desertification & mitigate the effects of drought.	++	++	++	++	++	+
5. Provide an enabling environment by strengthening the relevant existing legislation, enacting new laws, where they do not exist, and establish long-term policies and action programmes.	+	++	++	+	++	++
6. All affected developing country Parties shall prepare a National Action Programme, utilising and building to the extent possible, on existing relevant plans and programmes and sub-regional and regional action programmes, as the central element of strategy to combat desertification and drought.	The current exercise is towards fulfilling this obligation.					

Expl Note: +++ (Very Good), ++ (Good), + (Fair), x (Not Existing)

The CCD approach for the preparation of a National Action Programme is reproduced from Chapter 1 in Box 10.3 below in order to identify the strengths and weaknesses in our national framework for implementing the CCD Approach to Combating Desertification

Box. 10.3	CCD Approach to Desertification (Elements of the CCD)
	<ul style="list-style-type: none"> * Long-term Integrated strategies with identified priorities of action. * Consider all aspects of the problem - loss of agricultural productivity, reduced vegetation cover, socio-economic losses, social instability, etc. * Integration with other development programmes. * Key role of local communities. * Policy measures to provide an 'enabling environment' for such an approach. * Resources required - that available and those still needed to be identified.

Table 10.5: Analysis of Strengths and Weaknesses in Our National Framework for Following CCD Approach to Combating Desertification

CCD Approach for Combating Desertification	Position
1. Long-term Integrated strategies with identified priorities of action.	++
2. Consider all aspects of the problem - loss of agricultural productivity, reduced vegetation cover, socio-economic losses, social instability, etc.	++
3. Local Area Development Programme	+++
4. Social Sector and community based programmes	+++
5. Inter-departmental and Centre-State coordination and integration	+
6. Integration with other development programmes.	+
7. Decentralised governance	+
6. Key role of local communities in existing efforts.	+
7. Partnership between the public sector, private sector and the civil society	weak
8. Gender Related Issues	weak
9. Policy measures to provide an 'enabling environment' for such an approach.	++
10. Implementation of laws and regulations	weak
11. Resources required - that available and those still needed to be identified.	+
12. Awareness and dissemination of information to the local stakeholders	+

Expl Note: +++ (Very Good), ++ (Good), + (Fair)

In the context of preparation of our National Action Programme, it is desirable to pay more attention to those issues and measures that are identified as weak or fair. In this context, the following issues require greater attention:

- A greater shift from centralised mode of governance to more decentralised governance.
- Problems/priorities identified by the local communities and a greater devolution of powers to the local communities.
- Greater integration of existing programmes and activities and a more coordinated approach, particularly at the local level.
- Strive towards 'Single window' implementation of programmes and schemes through local self governments (*Panchayats*).
- Water would be made central to all conservation measures and for production systems.
- Use impact indicators. Improvement of quality of life central to the issue so that people's lives are improved and sustained and the local communities are empowered to take decisions, and implement programmes relating to their livelihood.
- Since there is large gap between fund requirements and availability, assistance on a grant/loan on concessional terms would be sought from the international community.

10.5 Proposed Line of Action and Resource Mobilisation for National Action Programme

10.5.1 Options Available for Preparation of NAP

This chapter proposes the line of action, in the context of the issues arising from Chapter 9 and 10 and the recommendations given thereunder, and the specific priority areas that could be taken for seeking fund assistance in the context of the UNCCD. There are five options available for seeking support under the UNCCD. These are:

- I Seeking financial support for the implementation of plan programmes and schemes of the Government that are not covered presently.
- II Preparation of a shelf-line of projects and schemes from issues and recommendations identified in Chapter 9 of this report.
- III A combination of I and II above.
- IV Identifying the most degraded land/areas falling in the drylands of the country for eco-restoration projects under the UNCCD.
- V Following the "China Model" of National Action Programme.

Each of these options are explained below:

Option I Financial Requirements for Implementation of Plan Schemes and Programmes of the Government on Desertification and Natural Resource Conservation

It is very much recognised by the Planning Commission that the Core sectors such as agriculture, rural development, water resources, energy and infrastructure form the backbone in the development of the country and be given priority. Though sectors such as health, education, women and child development, family welfare and other social sectors are also important in the context of sustainable development, the allocation for these important sectors has not been commensurate with the requirements or needs of these sectors as the funds of the magnitude necessary are not available within internal sources. For example, for the Ninth Five-Year Plan, the share of selected sectors is given in table 10.6.

Table 10.6: Financial Allocation of Selected Sectors in the Ninth Plan Outlay (1997-2002) (in Rs. Crores)

Sector	Plan Outlay	% of Total
Core Sectors:		
Agriculture & Minor Irrigation	37,546	4.4
Irrigation & Flood Control	55,598	6.5
Major & Medium Irrigation Projects		
Energy	21,554	25.1
Rural Development	73,439	7.9
S&T	25,529	
Environment & Forests		
Other Sectors:		
Social Services	182,005	21.2
Which includes Education, Medical & Public Health, Family Welfare, Housing, Urban Development, Water Supply & Sanitation, Social welfare		

Source: Government of India, * Ninth Plan Document, Planning Commission.

The low level of funding available for human development programmes has profound implications in achieving the desired objectives of sustainable development. Even within the major sectors such as agriculture and rural development, which take a major chunk of the allocation, funds are not sufficient to meet the entire needs of the sectoral objectives. For example, in regard to the extent of area covered under the various Plan schemes related to watershed development, it is estimated that up to the end of Eighth Five Year Plan, of the total 92 mha of rainfed areas, about 16.52 mha of rainfed areas (excluding the area covered under JRY and EAS) were covered. This accounts for about one-fifth of the requirement. Soil and water conservation plan and implementation under Centrally Sponsored Schemes on River Valley Projects and Flood Prone Rivers has been in operation since the Third Five-Year Plan. It is observed that only 4 mha of the total 26.52 mha ha of vulnerable catchments have so far been addressed. The pace of soil and water conservation measures has thus failed to bring about significant result considering the time taken to treat the vast catchment areas. There are similar problems in other schemes such as DDP, DPAP where the problem far outweighs the financial resources available presently to deal with the situation. Table 10.7 indicate deficits between the extent of coverage of programme and the extent of funding available and that required.

Table 10.7 Area covered and remaining under various Watershed Development Programmes up to the Eighth Five Year Plan:

Watershed development Programmes/projects	Area covered in (lakh ha)	Percent of non-arable land covered	Total Area Required to be treated (in m ha)	Req. Financial Resources for inclusion of the remaining area (in Rs. crores)**
1. NWDPR	45.84	24.7	92	
2. RVP	37.06	65.0] 26.52	
3. FPR	7.05	40.0		
4. DPAP	57.00	50.0	74.6	
5. DDP	5.51	50.0		
6. IWDP	4.00	100	63.9*	
7 Externally aided	10.00	10.0		
Total	165.16			

Source: Columns 1 & 2: Government of India 1997.

* As per NRSA estimates of 2000

** Under preparation

10.5.2 PERSPECTIVE ACTION PLANS PREPARED BY GOI FOR COMBATING DESERTIFICATION

There is no comprehensive integrated perspective plan for 2020 or 2050 for the sustainable development prepared or planned for the entire country. Sector specific strategies such as the Vision- 2025 prepared by the Ministry of Agriculture for Watershed-based programmes and the National Forestry Action Programme for afforestation of one-third of the country in a time-bound manner have been prepared (Table.10.7). The integrated watershed to cover an estimated area of 63 million hectare of rainfed areas that would be treated under various watershed development projects/programmes, involving an overall investment of Rs. 76,000 crores. The National Forestry Action Programme (NFAP) of the MOEF is a perspective plan for 20 years (2000-2020) to fulfil the objectives of having 33% of the country area under forest and tree cover in the country and for the sustainable removal of fuel-fodder to meet the country's requirements for an estimated at Rs. 1,339,027.8 million. In order to achieve this, an annual programme of afforestation and regeneration of 3 million ha is required,. This is estimated to require an annual budget of Rs.52850 million against the average

availability of Rs. 8160 million for forestry and wildlife sectors and Rs. 16150 million available if, afforestation programmes of other ministries are also taken into account. (NFAP, MOEF, GOI, 1999). The NFAP also incorporates the measures that could help in meeting the fuel wood-fodder needs of the country and their sustainable removal from the forests over the next 20 years. However these have no committed resources for implementing these perspective Plans.

These plans are in line with the national priorities and as per requirements of the CCD objectives of integrated and harmonised approach. The programme wise area covered and that required under all schemes for watershed development is summarised in Table 10.8 below:

Table. 10.8 Perspective Plans of the Government of India

S.N.	Perspective Plan	Prepared By	Plan Period	Will Address	Estimated Cost	Assured Financial Resources
1.	Integrated Watershed Programme (Vision 2025)	MOA	1997-2022	(1) Food requirements of the country, (2) Soil and water conservation in major catchment areas and river valley projects, flood prone rivers. (3) Integrated water shed approach for 7 schemes, (4) Participatory approach.	Rs. 76, 000 crores	Not Available
2.	National Forestry Action Programme (NFAP)	MOEF	2000-2020	(1) For afforestation of 33% of country's area, (2) To meet the fuelwood-fodder requirements from forests in a sustainable manner.	1,339,027.8 million rupees	Not Available

The costs for major programmes such as above on a long-term perspective plan are extremely high. The scope of covering the broad areas such as sustainable water management, conservation of natural resources, community and social-sector schemes, etc., are also similarly vast and the costs for inclusion of all such uncovered areas is expected to be enormously high. It is difficult for the GOI to possibly cover all areas to the extent required. The UNCCD could be used to obtain fund support for some of these on-going activities and activities under a perspective plan which could be dovetailed into the existing programmes and projects.

Option II Preparation of Projects on Issues and Recommendations for Combating Desertification.

A number of issues which are presenting as barriers - policy barriers, technological barriers, constraints in institutional arrangements, gaps/shortcomings, etc., have been identified and presented in Chapter 9, which still require to be addressed in the context of addressing land degradation and combating desertification in the country. Some of the most important activities thereunder could be identified and taken up under the UNCCD as a complementary set of package of measures along with the on-going programmes outlined in Chapters 6 & 7. As a first step, these would require to be evaluated and prioritised in terms of their importance, and the costs and time required for their formulation and effective implementation.

Option III The third option is to seek fund assistance for projects and schemes from a combination of Option I and Option II. This may also be useful strategy for addressing the problem of desertification in the context of the UNCCD.

Option IV Identifying the most degraded land/areas falling in the drylands of the country for eco restoration projects under the UNCCD.

The basic objective of the Convention as outlined in Article 4 of Annex II - National Action Programme for affected Asian country Parties, to prepare long-term integrated strategies to achieve the objective of poverty eradication. In view of this, it is imperative that long-term strategies for addressing the most affected areas and the most vulnerable social groups be prepared. It may be useful to identify areas in the country focussing the resources to improving the targeted areas. This would help concentrate the efforts on the most impoverished groups and degraded areas in a concerted manner. Most affected areas of the drylands could be identified based on existing information available. Most vulnerable groups susceptible to environmental degradation such as the small and marginal farmers, women and backward communities should be selected for such programmes.

Option V Follow the “China Model” of National Action Programme to Combat Desertification

The fifth option available for addressing the problem is to follow the China - National Action Programme. China has estimated that about 27.32 % of its total land is degraded threatening about 400 million of its population. The country is incurring an annual direct economic loss of approximately US \$ 6.5. billion. Copies of the China NAP were circulated to all the key ministries and departments of the Government of India and is summarised below:

The strategy of the China NAP is divided into three phases namely:

Phase 1	from 1996 to 2000
Phase 2	from 2001 to 2010
Phase 3	from 2011 to 2050

These coincide with the time schedule of China National Economic and Social Development Plan. The broad elements of each of these phases is given below.

<p>Box 10.4 China National Action Programme</p> <p>Objectives of Phase 1 (1996-2000)</p> <ul style="list-style-type: none"> - To slow down the spread of desertification. - Eco restoration of some regions. - Improve people's quality of life and living conditions. - 2.80 mha of land affected by wind erosion will be rehabilitated - 2.40 mha of land affected by water erosion will be reafforetted (600,000 ha will be by artificial plantation) - 7.15 mha of degraded steppe, desert steppe and rangelands will be revegetated. - 2.0 mha of salinised/alkalinised land will be appropriately reclaimed. - 165 natural reserves and preservations in arid, semi-arid and dry sub-humid ares will be established, covering a total area of 59.5 mha.
<p>Objectives of Phase 2 (2001-2010)</p> <ul style="list-style-type: none"> - Remarkable improvements in the ecological conditions of the affected areas. - Improvements in the quality of people's lives and living conditions.

<ul style="list-style-type: none">- Additional Targets (in addition to phase 1) are:- 6.00 mha of land affected by wind erosion will be rehabilitated.- 4.80 mha of lands affected by water erosion will be afforested (600,000 ha will be of artificial plantation).- 17.50 mha of degraded rangelands will be improved through revegetation.- 5.00 mha of salinised/alkalised land will be properly reclaimed.- The total area of natural reserves and preservation in arid, semi-arid and dry sub-humid areas will be Increased by 68.68 mha.
<p>Objectives of Phase 3 (2011-2050)</p> <p>Nearly all desertified land will be rehabilitated. The total area of natural reserves would now be 91.35 mha and the ecosystem in the affected areas will be fully restored and the economic development promoted.</p>

The key principles of China NAP are:

1. Priority would be given to protective measures.
2. Techniques adopted would be suitable to local conditions.
3. Management of key projects be divided into phases with an appropriate time-frame.
4. Implementation of projects be divided into phase with an appropriate time-frame.
5. Supervising and monitoring mechanisms to be strengthened.
6. Greater attention to the cost-benefit aspects.
7. Immediate objectives be combined with long-term objectives.

The Government of China have also set up a **National Co-ordinating Body (NCB)**, namely the China National Committee for the Implementation of the UNCCD (CCICCD), which is authorised to look exclusively into the formulation and implementation of the China-NAP in the context of the UNCCD. The cost of implementation of the China-NAP is not indicated in the Summary Report. However, the cost of 'backbone projects' identified for Phase-2 (2000-2010) is estimated as RMB 22.89 billion Yuan.

For our country, although Vision 2020/ 2025 plans have been prepared by individual ministries such as the MOEF and MOA, for specific programmes, the Government has however not initiated an exercise for preparation of a **Perspective Vision 2020 or Vision 2050 for the "Sustainable Development of the Country"**, incorporating all the relevant stakeholders, who impact the sustainable development of the country and encompassing all relevant issues such as:

- Natural resource conservation and management,
- Socio-economic issues,
- Strengthening the process of decentralisation of governance and formulation of more community driven projects and programmes,
- Gender issues,
- Public participation,
- Strengthening the interface and co-ordination between various stakeholders, and
- Awareness raising.

It is for consideration if we follow the Chinese strategy of preparation of a 50-year NAP and or prepare a Vision-2050 for Sustainable Development for the country, that effectively addresses the issue of desertification. The recommendation of the Planning Commission for an "Umbrella Plan of Action to Combat Desertification" under the UNCCD, with good inter-departmental co-ordination requires to be examined in this context.

The five options suggested above are in line with the national priorities and as per requirements of the CCD objectives of integrated and harmonised approach and have been discussed in detail with relevant Ministries for the basis for preparation of the National Action Programme.

10.6 External Funding for Projects Identified under the CCD Process

10.6.1 External Funding for NAP Formulation and Implementation

The external funding mechanisms available for the implementation of the projects can be considered under the following categories: (Chapter 8, sub-section: 8.6)

- (I) Global Mechanism.
- (II) International organisations such as the UNDP, UNEP, IFAD, FAO, WMO etc which could take up specific projects/programmes for assistance, which are identified in the context of the combating desertification under the UNCCD.
- (III) Bilateral assistance:
- (IV) Multilateral assistance: ADB, World Bank.
- (V) GEF assistance,

The Global Mechanism has stated that it is important to remember that since by the end of this year almost all affected countries would have prepared the National Action Programme, one can expect a competitive process between many requests for support from various funding agencies. Timely and well prepared projects and requests received from countries and responses in fine tuning with the requirements of the donors could help in accessing substantial amount of funds.

10.7 Other Important Issues for the National Action Programme

- Establishing a Monitoring Mechanism for evaluation of programmes and schemes for combating desertification.

- Rationalising the existing programmes: The planning process has over the decades evolved from a centralised planning system to building a long-term strategic planning with indicative priorities of the nation. It also aims to work out sectoral targets and provide promotional stimuli to the economy to grow in the desired direction. The Planning Commission in the coming years will play a more integrative role in the development to policy formulation in critical areas of human and economic development. In the social sector, schemes which require co-ordination and synthesis such as rural health, drinking water, rural energy needs, literacy and environmental protection have to be co-ordinated and integrated further. The Planning Commission is of the view that apart from multiplicity of agencies, there is also the problem of proliferation of programmes. It is of the view that rather than multiplying the programmes, which tend to lose focus, there is a need to rationalise the existing programmes to achieve a more focussed and integrated implementation.

- Continuing the process of decentralisation. Planning Commissions is in the process of transferring some of the centrally sponsored schemes to the States. This is in line with the demand made by the States as well as in consonance with the objective of decentralisation.

- Review of NAP: It is also important to mention here that the NAP is not a one-time process, but would be a dynamic process to regularly review, incorporate, and modify as per objectives, requirements of the UNCCD for combating desertification, that evolve over time.

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India has a deep rooted cultural history of love for nature and its conservation. The traditional wisdom of dryland farming, water harvesting, use of traditional, cost-effective technologies and frugal consumption of natural resources have helped in protection of our natural resources over many centuries. However, with barely 2.4% of the total land area of the world, our country has to support 16.7 % of the total human and 18 % of the total cattle population of the world. The most critical challenge of the 21st century, with this burgeoning human and cattle population, would therefore be in meeting the food-fuel-fodder and water needs of the country. The success achieved on the food front during the “Green Revolution’ would require to be sustained. In order to improve the economy and general standard of living in the coming decades, energy and industrial production will have to be increased. All these can put tremendous strain on the natural resources of the country, unless very stringent measures are taken to prevent and control degradation of our land, water, air and other natural resources. The data available on the land degradation indicate that about one-third of our total geographical area is facing some form of degradation or the other. Land degradation is acute in rainfed regions of the country, which mostly comprise of the arid, semi-arid and dry sub-humid regions. The most serious forms of land degradation are from water and wind erosion and by deforestation accounting for more than 50% of the total land degradation, which is a matter of concern. Land degradation and desertification is a serious problem in the country resulting in loss of productivity of soils, and natural resources such as forestry, bio-diversity, etc. It is also affecting the socio-economic and living conditions of the people particularly in the affected regions which has ramifications and impacts on the socio-economic development of the country at the macro-level. The problem of desertification is complex involving the bio-physical, social, economic and political factors.

The Government of India had initiated a number of measures for the protection and conservation of our natural resources and ecosystems right from the inception of the First Five-Year Plan. Over the last few decades, a large number of initiatives have been taken to strengthen programmes and schemes, policy outlines and institutional framework in the sectors of agriculture, rural development, environment and forests, social welfare, poverty alleviation, which have a direct impact in improving the economy and protection of our resources. A number of policies, strategies, programmes and measures have also been initiated during last ten years, which are in tune with the objectives of the UN Convention to Combat Desertification. The Constitution of India was also amended to give more power and role to the local community. However, in order to meet the challenges of food-fuel-fodder and water requirements of the country and for improving the socio-economic conditions, particularly of the local communities in a sustainable manner; new strategies and funding mechanisms, would require to be identified and implemented in a time-targeted and integrated manner.

The United Nations Convention to Combat Desertification (UNCCD) provides a platform for taking up suitable measures to achieve the goals of sustainable development through the preparation and implementation of a National Action Programme (NAP) for combating desertification and mitigating the effects of drought in the country.

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ANNEXES



SECRETARIAT OF THE UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION



STATUS OF RATIFICATION
(* = Accession) as of 10 December 2000

1. Mexico	03/04/95	61. Yemen*	14/01/97	121. Comoros	03/03/98
2. Cape Verde	08/05/95	62. Paraguay	15/01/97	122. St Vincent & Grenadines	16/03/98
3. Netherlands	27/06/95	63. Luxembourg	04/02/97	123. European Community	26/03/98
4. Egypt	07/07/95	64. China	18/02/97	124. Turkey	31/03/98
5. Senegal	26/07/95	65. Pakistan	24/02/97	125. Marshall Islands*	02/06/98
6. Ecuador	06/09/95	66. Côte d'Ivoire	04/03/97	126. Venezuela*	29/06/98
7. Lesotho	12/09/95	67. Cuba	13/03/97	127. Sao Tome and Principe	08/07/98
8. Finland	20/09/95	68. Mozambique	13/03/97	128. Belize*	23/07/98
9. Togo	04/10/95	69. Iran	29/04/97	129. Azerbaijan*	10/08/98
10. Tunisia	11/10/95	70. Greece	05/05/97	130. Niue*	14/08/98
11. Guinea-Bissau	27/10/95	71. Barbados*	14/05/97	131. Romania*	19/08/98
12. Mali	31/10/95	72. Namibia	16/05/97	132. Cook Islands*	21/08/98
13. Uzbekistan	31/10/95	73. Grenada*	28/05/97	133. Samoa*	21/08/98
14. Afghanistan*	01/11/95	74. Cameroon	29/05/97	134. Viet Nam*	25/08/98
15. Peru	09/11/95	75. Austria*	02/06/97	135. Fiji*	26/08/98
16. Sudan	24/11/95	76. Iceland*	03/06/97	136. Indonesia	31/08/98
17. Canada	01/12/95	77. Antigua and Barbuda	06/06/97	137. Kiribati*	08/09/98
18. Sweden	12/12/95	78. Syrian Arab Republic	10/06/97	138. Guatemala*	10/09/98
19. Denmark	22/12/95	79. Djibouti	12/06/97	139. Japan	11/09/98
20. Switzerland	19/01/96	80. France	12/06/97	140. Tuvalu*	14/09/98
21. Niger	19/01/96	81. Tanzania	19/06/97	141. Nauru*	22/09/98
22. Mauritius	23/01/96	82. Guinea	23/06/97	142. Tonga*	25/09/98
23. Bangladesh	26/01/96	83. Italy	23/06/97	143. United Arab Emirates*	21/10/98
24. Burkina Faso	26/01/96	84. Kenya	24/06/97	144. Rwanda	22/10/98
25. Spain	30/01/96	85. Brazil	25/06/97	145. Sri Lanka*	09/12/98
26. Micronesia	25/03/96	86. Honduras	25/06/97	146. Uruguay*	17/02/99
27. Israel	26/03/96	87. Madagascar	25/06/97	147. Monaco*	05/03/99
28. Portugal	01/04/96	88. Malaysia	25/06/97	148. Republic of Moldova*	10/03/99
29. Panama	04/04/96	89. Saudi Arabia*	25/06/97	149. Qatar*	15/03/99
30. Lebanon	16/05/96	90. Uganda	25/06/97	150. Solomon Islands*	16/04/99
31. Algeria	22/05/96	91. Dominican Republic	26/06/97	151. Singapore*	26/04/99
32. Gambia	11/06/96	92. Equatorial Guinea	26/06/97	152. Colombia	08/06/99
33. Malawi	13/06/96	93. Guyana*	26/06/97	153. Palau*	15/06/99
34. Germany	10/07/96	94. Seychelles	26/06/97	154. Republic of the Congo	12/07/99
35. Libyan Arab Jamahiriya	22/07/96	95. El Salvador*	27/06/97	155. Hungary*	13/07/99
36. Oman*	23/07/96	96. Ethiopia	27/06/97	156. Georgia	23/07/99
37. Bolivia	01/08/96	97. Kuwait	27/06/97	157. San Marino*	23/07/99
38. Mauritania	07/08/96	98. Angola	30/06/97	158. Vanuatu	10/08/99
39. Eritrea	14/08/96	99. Belgium*	30/06/97	159. Republic of Korea	17/08/99
40. Benin	29/08/96	100. St. Kitts and Nevis*	30/06/97	160. Liechtenstein*	29/12/99
41. Norway	30/08/96	101. Armenia	02/07/97	161. Czech Republic*	25/01/00
42. Mongolia	03/09/96	102. Saint Lucia*	02/07/97	162. Philippines	10/02/00
43. Central African Rep.	05/09/96	103. Nigeria	08/07/97	163. Cyprus*	29/03/00
44. Gabon*	06/09/96	104. Kazakhstan	09/07/97	164. Albania*	27/04/00
45. Botswana	11/09/96	105. Bahrain*	14/07/97	165. Australia	15/05/00
46. Turkmenistan	18/09/96	106. Tajikistan*	16/07/97	166. Suriname*	01/06/00
47. Zambia	19/09/96	107. Ireland	31/07/97	167. Trinidad and Tobago*	08/06/00
48. Lao (PDR)	20/09/96	108. Cambodia	18/08/97	168. New Zealand*	07/09/00
49. Haiti	25/09/96	109. Dem. Rep. of Congo	12/09/97	169. Croatia*	06/10/00
50. Chad	27/09/96	110. Kyrgyzstan*	19/09/97	170. Bahamas*	10/11/00
51. Swaziland	07/10/96	111. Zimbabwe	23/09/97	171. United States of America	17/11/00
52. Nepal	15/10/96	112. Sierra Leone	25/09/97	172. Papua New Guinea*	06/12/00
53. United Kingdom	18/10/96	113. South Africa	30/09/97		
54. Jordan	21/10/96	114. Chile	11/11/97		
55. Morocco	12/11/96	115. Jamaica*	12/11/97		
56. India	17/12/96	116. Dominica*	08/12/97		
57. Ghana	27/12/96	117. Costa Rica	05/01/98		
58. Myanmar*	02/01/97	118. Malta	30/01/98		
59. Argentina	06/01/97	119. Nicaragua	17/02/98		
60. Burundi	06/01/97	120. Liberia*	02/03/98		

UN CONVENTION TO COMBAT DESERTIFICATION

Part I

Article 1	Use of Terms: Desertification, combating desertification, drought, mitigating the effects of drought, land, land degradation, arid, semi-arid and dry sub-humid areas, affected areas, affected countries, regional economic integration organisation, developed country Parties.
Article 2	Objective
Article 3	Principles

Part II - General Provisions

Article 4	General Obligations to implement the Convention.
Article 5	Obligations of Affected Country Parties
Article 6	Obligations of Developed Country Parties
Article 7	Priority for Africa - Priority to affected African Country Parties while not neglecting affected developing country Parties in other regions.
Article 8	Relationship with Other Conventions

Part III - Action Programmes, Scientific and Technical Cooperation and Supporting Measures

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Article 10	National Action Programmes
Article 11	Subregional and Regional Action Programmes
Article 12	International Cooperation
Article 13	Support for the Elaboration and Implementation of the Action Programmes
Article 14	Coordination in the Elaboration and implementation of Action Programmes
Article 15	Regional Implementation Annexes

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Article 17	Research and Development
Article 18	Transfer, Acquisition, Adaptation and Development of Technology

Section 3: Supporting measures

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Article 20	Financial Resources
Article 21	Financial Mechanisms

Part IV- Institutions

Article 22	Conference of the Parties
Article 23	Permanent Secretariat

Article 24	Committee on Science and technology
Article 25	Networking of Institutions, Agencies and Bodies

Part V- Procedures

Article 26	Communication of Information
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ANNEX I - Regional Implementation Annex for Africa

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Article 4	Commitments and obligations of African Country Parties
Article 5	Commitments and obligations of Developed Country Parties
Article 6	Strategic Planning Framework For Sustainable Development
Article 7	Timetable For Preparation of Action Programmes
Article 8	Content of National Action Programmes
Article 9	Preparation of National Action Programmes and Implementation and Evaluation Indicators
Article 10	Organisational Framework of Subregional Action Programmes
Article 11	Content and Preparation of Subregional Action Programmes
Article 12	Organisational Framework of the Regional Action Programmes
Article 13	Content of the Regional Action Programme
Article 14	Financial Resources
Article 15	Financial Mechanisms
Article 16	Technical Assistance and Cooperation
Article 17	Transfer, Acquisition, Adaptation and Access to Environmentally Sound Technology
Article 18	Coordination and partnership Agreements
Article 19	Follow-up Arrangements

ANNEX II - Regional Implementation Annex for Asia

Article 1	Purpose
Article 2	Particular Conditions of the Asian Region
Article 3	Framework for National Action Programmes

Article 4	National Action Programmes
Article 5	Subregional and Joint Action Programmes
Article 6	Regional Activities
Article 7	Financial Resources and Mechanisms
Article 8	Cooperation and Coordination Mechanisms

ANNEX III - Regional Implementation Annex for Latin America and the Caribbean

Article 1	Purpose
Article 2	Particular Conditions of the Latin American and Caribbean Region
Article 3	Action Programmes
Article 4	Content of National Action Programmes
Article 5	Technical, Scientific and Technological Cooperation
Article 6	Financial Resources and mechanisms
Article 7	Institutional Framework

ANNEX IV- Regional Implementation Annex for the Northern Mediterranean

Article 1	Purpose
Article 2	Particular Conditions of the Northern Mediterranean Region
Article 3	Strategic Planning Framework for Sustainable Development
Article 4	Obligation to Prepare National Action Programmes and timetable
Article 5	Preparation and implementation of National Action Programmes
Article 6	Content of National Action Programmes
Article 7	Subregional, Regional and Joint Action Programmes
Article 8	Coordination of Subregional, Regional and joint Action Programmes
Article 9	Non-eligibility for Financial Assistance
Article 10	Coordination with other Subregions and regions

Annex-3

(Chapter 3, Sub-Section 3.8.2, page 29)

Classification of Major Regions, Agro-Ecological Regions (AERs) and Sub-Regions(AESRs) as per Thornthwaite Classification

S. N	MAJOR REGION S	S. N.	AGRO-ECOLOGICAL REGIONS	S. N.	AGRO-ECOLOGICAL SUB-REGIONS		
1.	ARID	1	Western Himalayas Cold Arid Eco-Region.	1.1	Lakhak plateau cold, hyperarid eco-subregion.		
				1.2	Western aspect of Ladak plateau and northern Kashmir Himalaya cold typic arid eco-subregion.		
		2.	Western Plain, Kutchh and part of Kathiawar pennisula hot arid eco-region.	2.1	Marusthali hot, hyper arid eco subregion.		
				2.2	Kacchh pennisula (Great Rann of Kutchh inclusion) hot hyperarid sub region.		
				2.3	Rajasthan Bagar, North Gujarat plain and south western Punjab plain, hot typic arid eco subregion.		
				2.4	South Kutchh and North Kathiawar pennisula, hot typic arid eco-subregion.		
		3	Deccan Plateau hot arid eco-region.	3	Decaan Plateau hot arid ecoregion.		
		2.	SEMI-ARID	4	Northern Plain and central highlands including Aravallis hot-semi-arid eco-region.	4.1	North Punjab plain, Ganga-Yamuna Doab and Rajasthan upland, hot dry semi-arid eco-sub region.
						4.2	North Punjab plain 9inclusive of Aravali range and East Rajasthan uplands) hot dry semi-arid eco sub region
						4.3	Ganga-Yamuna Doab, Rohilkahnd and Avadh plain hot moist semi arid eco subregion.
4.4.	Madhya Bharat pathar and Bundelkhand uplands, hot moist semi-arid eco sub-region.						
5	Central (Malwa) highlands, Gujarat plains, & Kathiawar Pennisula hot semi-arid eco-region.			5.1	Central Kathiawar pennisula, hot dry semi-arid ecosubregion.		
				5.2	Madhya Bharat plateau Western Malwa district, Eastern Gujarat plain, Vindhya and Satpura range and Narmada Valley hot moist smi-arid eco sub region.		
				5.3	Coastal Kathiawar pennosula, hot moist semi-arid ecoregion.		
6	Deccan Plateau hot semi-arid eco-region.			6.1	South western Maharashtra and north Karnataka plateau, hot dry semi-arid ecosubregion.		
				6.2	Central and Western Maharashtra plateau and north Karnataka plateau and north western Telenagan plateau hot moist semi-arid eco sub region.		
				6.3	Eastern Maharashtra plateau hot moist semi-arid eco subregion.		
				6.4	North Sahydris and Western Karnataka plateau, hot dry sub humid eco sub region.		
7	Deccan (Telangana) Plateau & Eastern Ghats hot arid eco-region.			7.1	South Telangana pleateau (Rayalseema) and Eastern Ghat, hot dry semi-arid eco subregion.		
				7.2	North Telangana plateau, hot moist semi-arid dry sub humid eco sub region.		
				7.3	Eastern Ghat (south) hot, moist semi-arid dry sub humid eco sub region.		
8	Eastern Ghats, Tamil Nadu Uplands & Deccan (Karnataka) Plateau hot semi-arid region.			8.1	Tamil Nadu, uplands,and Leeward flanks of South sahydris, hot dry semi-arid eco sub region.		
				8.2	Central Karnataka plateau, hot moist semi-arid eco sub-region.		
				8.3	Tamil Nadu uplands and plains, hot moist semi-arid eco-sunb region.		

3.	SUB-HUMID	9	Northern Plain hot semi-arid (dry) eco-region.	9.1	Punjab and Rohilkhand plains, hot moist semi-arid eco sub region.		
				9.2	Rohilkhand, Avadh, and South Bihar plains, hot dry sub humid eco sub region.		
		10	Central Highlands (Malwa, Budelkhand & Eastern Satpura) hot semi-humid eco-region.	10.1	Malwa plateau, Vindhya scarpland and Narmada valley, hot dry sub-humid eco sub region.		
				10.2	Satpura and eastern Maharashtra plateau, hot dry sub humid eco sub region.		
				10.3	Vindhya scarpland and Baghelkhand plateau, hot dry sub humid eco sub region.		
				10.4	Satpura range and Waiganga valley, hot moist sub humid eco sub region.		
		11	Eastern Plateau (Chhattisgarh) hot sub-humid eco-region.	11.0	Moderately to gently sloping Chhattisgarh/Mahanadi basin, hot sub humid eco sub region.		
		12	Eastern (Chhotanagpur) Plateau & Eastern Ghats hot sub-humid eco-region.	12.1	Gujarat Hills, Dandakaranya, and Eastern Ghats, hot moist sub humid eco-sub region.		
				12.2	Eastern Ghats, hot moist sub humid eco sub region.		
				12.3	Chhotanagpur plateau and Gujarat hills hot dry and moist sub humid transitional eco sub region.		
		13	Eastern Plains hot (moist) sub-humid eco-region.	13.1	North Bihar and Avadh plains, hot dry moist sub humid eco sub region.		
				13.2	Foothills of Central Himalayas warm to moist sub humid eco sub region.		
		14	Western Himalayas warm sub-humid to humid inclusion of per-humid eco-region.	14.1	South Kashmir and Punjab Himalayas cold and warm dry semi arid eco sub region.		
				14.2	South Kashmir and Kumaon Himalayas cold and warm dry semi arid eco sub region.		
				14.3	Himalayas warm humid to per humid eco sub region.		
				14.4	Kumaon Himalayas, warm humid to per humid eco sub region.		
				14.5	Foothills of Kumaon Himalayas (subdued) warm, humid to per humid eco sub region.		
		4.	HUMID/PER-HUMID	15	Bengal and Assam Plain, hot sub-humid (Moist) to humid (inclusion of per-humid) eco-region.	15.1	Bengal and assam Plain, hot sub humid (moist) to humid (inclusion of per humid) eco sub region.
						15.2	Middle Brahmaputra plain, hot humid eco sub region.
15.3	Teesta, lower Brahmaputra plain and Barak valley, hot moist humid to per humid eco sub region.						
15.4	Upper Brahmaputra plains, warm to hot per humid eco sub region.						
16	Eastern Himalayas warm per-humid eco-region.			16.1	Foothills of Eastern Himalayas (bhutan Foothills), warm to hot per humid Terai eco sub region.		
				16.2	Darjeeling and Sikkim Himalayas perhumid eco sub region.		
				16.3	Arunachal Pradesh (subdued Eastern Himalayas) warm to hot per humid eco sub region.		
17	North-eastern Hills (Purvanchal) warm per-humid eco-region.			17.1	Meghalaya plateau and Nagaland hill, warm to hot moist humid to per humid eco sub region.		
				17.2	Purvanchal (Eastern range) warm to hot per humid eco sub region.		

5.	COASTAL (ranges from semi-arid to hot humid)	18	Eastern coastal Plain hot sub-humid to semi-arid eco-region.	18.1	South tamil Nadu (coastal) hot dry semi arid eco sub region.
				18.2	North Tamil Nadu plains (coastal) hot dry semi arid eco sub region.
				18.3	Andhra coastal hot dry sub humid eco sub region.
				18.4	Utkal palin and East Godavari delta, hot dry sub humid eco sub region.
				18.5	Gangetic delta, hot moist sub humid eco sub region.
		19	Western Ghats & Coastal Plain hot humid per-humid eco-region.	19.1	North Sahydris and Konkan Coast, hot humid eco sub region.
		19.2	Central and South Sahydris, hot moist sub humid to humid eco sub region.		
		19.3	Konkan, Karnataka, and kerala, Coastal plain, hot humid to per humid eco sub region.		
6.	ISLAND	20	Islands of Andaman-Nicobar and Lakshwadeep hot humid to per-humid island eco-region.	20.1	Andaman and Nicobar Group of Island hot per humid eco sub region.
				20.2	Level Lakshwadeep and group of islands hot humid eco sub region.

Source: ICAR, 2001

Explanatory Note:

Thornthwaite classification is as per the formula: $\frac{P-PE}{PE}$, where, P: Precipitation, and PE: Potential Evapotranspiration

As per this, the regions are classified as given below:

REGION	Thornthwaite Classification (P-PE/PE)
Hyper-Arid	> -0.95
Arid	-0.95 to -0.80
Semi-Arid	-0.80 to -0.50
Dry Sub-Humid	-0.50 to -0.35
Humid/Per Humid	>0.65

DROUGHT INCIDENCES IN INDIA AND THEIR INTENSITY
(1875 ONWARD)

	1875	77	79	81	83	85	87	89	91	93	95	97	99	1901	3	5	7	9	11	13	15	17	19	21	23	25	27		
1 North Assam									0																				
2 South Assam					0						0																		
3 West Bengal					0			0																					
4 West Bengal																													
5 Orissa			0											0															
6 Bihar Plateau														0												0			
7 Bihar Plains		0																											
8 East Uttar Pradesh			•		0						0																		
9 West Uttar Pradesh			•		0												0												
10 Hayana, Delhi & Chandigarh			•		0							0	•			0	0				0	•	0						
11 Punjab													•			0	0				0	0	0	0					
12 Himachal Pradesh			0		0								0			0	•												
13 Jammu & Kashmir			0	•	•	•	0	•			0	0	0	0		0	•												
14 Rajasthan West			•		0		0		•				•	•	0	•				0		•	0				0		
15 Rajasthan East			•		0		0		0			0	0	0		•	0			0		•	0				0		
16 Madhya Pradesh West			0													0	0												
17 Madhya Pradesh East			0																										
18 Gujarat Region			•		0			0					•	0		•						•	0			0	0		
19 Saurashtra & Kutch		0	•					0	0				•	•	0	•						•	0			•	0		
20 Konkan & Goa			0										0			0													
21 Madhya Maharashtra			0										•	•	0	0				0		•	0						
22 Marathwada			0			0										0	0						•				0		
23 Vidarbha			0										•		0	0							0						
24 Coastal Andhra Pradesh			0				0						0			0							0						
25 Telangana			0	0									0																
26 Rayalseema			0		0						0		0	0		•	0				0	0				0			
27 Tamil Nadu & Pondichery						0							0			0													
28 Coastal Karnataka				0									0																
29 North Interior Karnataka			0										0			0									0	0			
30 South Interior Karnataka			0													0													
31 Kerala														0															

0 MODERATE DROUGHT (Rainfall deficiency 26% to 50% of the normal) • SEVERE DROUGHT (Rainfall deficiency exceeding 50% of the normal)

BASED ON JUNE - SEPTEMBER RAINFALL

DROUGHT INCIDENCES IN INDIA AND THEIR INTENSITY (1927 ONWARD)

	1928	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
1 North Assam																											
2 South Assam																											
3 West Bengal																				0							
4 West Bengal																				0							
5 Orissa																											
6 Bihar Plateau																				0							
7 Bihar Plains			0																	0							
8 East Uttar Pradesh	0		0																	0							
9 West Uttar Pradesh	0							0																			
10 Haryana, Delhi & Chandigarh	0	0				0	0	0											0								
11 Punjab	0	0				0	0												0								
12 Himachal Pradesh	0																		0								
13 Jammu & Kashmir								0											0								
14 Rajasthan West							0												0								
15 Rajasthan East	0						0												0								
16 Madhya Pradesh								0											0								
17 Madhya Pradesh West								0											0								
18 Madhya Pradesh East																			0								
19 Gujarat Region									0										0								
20 Saurashtra & Kutch			0																0								
21 Konkan																											
22 Madhya Maharashtra																											
23 Marathwada																											
24 Vidarbha																				0							
25 Coastal Andhra Pradesh																			0								
26 Telangana																											
27 Rayalseema																				0							
28 Tamil Nadu & Pondichery			0																	0							
29 Coastal Karnataka																											
30 North Interior Karnataka																											
31 South Interior Karnataka																											
32 Kerala																			0								

DROUGHT INCIDENCES IN INDIA AND THEIR INTENSITY (1981 ONWARDS)

	1981	1983	1985	1987	1989	1990	1992	1994	1996	1998	2000
1. Andaman & Nicobar					0			0			
2. Arunachal Pradesh											0
3. Assam & Meghalaya											
4. Nagaland, Mizoram & Tripura						0			0		
5. South West Bengal										0	
6. Gangetic West Bengal											
7. Orissa							0				
8. Bihar Plateau				0					0		
9. Bihar Plains				0				0			
10. East Uttar Pradesh							0				
11. Plains of West U.P.							0				
12. Hills of West U.P.				0				0			
13. Haryana, Delhi & Chandigarh						0	•				
14. Punjab							•				
15. Himachal Pradesh			0	0	0	0	•	0			
16. Jammu & Kashmir				0				0			
17. West Rajasthan			0	0		0	•	0			
18. East Rajasthan							0	0			0
19. West Madhya Pradesh							0				0
20. East Madhya Pradesh										0	0
21. Gujarat Region				0		•	•				0
22. Saurashtra & Kutch				0		•	•	0	0	0	•
23. Konkan & Goa						0					
24. Madhya Maharashtra						0					
25. Marathwada					0	0			0		
26. Vidarbha				0		0	0				
27. Coastal Andhra Pradesh					0		0				
28. Telangana						0				0	
29. Rayalaseema						0					
30. Tamil Nadu & Pondicherry											0
31. Coastal Karnataka											
32. North Karnataka											
33. South Karnataka						0					
34. Kerala											
35. Lakshadweep											

0 MODERATE DROUGHT (Rainfall deficiency 26% to 50% of the normal)
 BASED ON JUNE - SEPTEMBER RAINFALL [Note: These data are presented on a Sub-Divisional scale. Districts within the sub-divisions may, however, show wide variations/fluctuations.
 The concept of drought on a smaller scale is under review.]

•SEVERE DROUGHT (Rainfall deficiency exceeding 50% of the normal)

Source: India Meteorological Department, Pune.

EVOLUTION OF PLAN PROGRAMMES OF THE PLANNING COMMISSION FOR DEVELOPMENT¹

First Five-Year Plan (1951-56): . The First Five-year Plan commenced when the economic situation in the country was far from favourable. It aimed at correcting the disequilibrium in the economy caused by the War and partition of the country. It proposed to initiate simultaneously a process of all-round balanced development which would ensure a rising national income. Focussed on building the economy from post-partition and aimed at building institutions which were considered necessary for development of the economy and for self reliance. Agriculture was the major sector on which the economy was centred

Second Five-Year Plan (1956-61): It aimed at accelerating the rate of growth and initiating a strategy to bring about the necessary structural changes in the economy. While agriculture continued to get high priority, there was due emphasis on industrialisation. "A socialist pattern of society" was explicitly accepted as the goal of the country's programme for social and economic development. The pattern of development was planned that they not only resulted in appreciable increases in national income and employment but also in greater equality. The benefits of economic development was to accrue more and more to the relatively less privileged classes of society. The Plan also defined the immediate task of laying down the foundation of a self-reliant economic growth.

Third Five-Year Plan (1961-66): The 3rd Plan was conceived as "first stage of a decade or more of intensive development leading to a self-reliant and self-generating economy". The basic criterion of the Plan was social gain rather than private profit. The Plan had setback due to drought conditions leading to steep fall in agricultural production over two successive years (1965-66 and 1966-67). The period also saw virtual stop of external credits. The rupee was devalued in 1966 and a period of readjustment followed. In these constraints, the finalisation of the 4th Plan due from April 1966 was delayed by 3 years. The Plan period was also marked by a trade deficit and mounting debt obligations. In 1967-68, there was a sharp recovery of agricultural output due to favourable weather conditions and widespread use of new varieties of seeds, fertilisers, pesticides, etc. This was the beginning of the era of "**the Green Revolution**". Food grain production which fell from 82 million tonnes (mt) in 1960-61 to 72 in 1965-66 was expected to be about 98 mt in 1968-69. Investment in private sector fell into two broad components: (a) organised sector of industry, mining, electricity and transport and (b) agriculture, village and small industries, rural and urban housing, etc.

Fourth Five-Year Plan (1969-74): The main objectives of the 4th Plan were:

- (i) To increase the pace of growth.
- (ii) Increase agricultural output.
- (iii) Reduce imports and increase exports by about 7% a year.
- (iv) Improve the functioning of the public sector undertakings.
- (v) Benefits of the development to reach the poor. Disparities in income to be reduced. Benefits of development to flow in the underdeveloped regions of the country. Specific programmes for social integration of backward communities into the mainstream rural communities.

¹ Five-Year Plan Documents of the Planning Commission, Government of India, New Delhi

- (vi) Increase employment opportunities.
- (vii) Shift of emphasis to district and local planning.
- (viii) Greater participation of *panchayati raj* institutions in the formulation of district plans. It also proposed to make their responsible for implementing local programmes and schemes.

In the beginning of the 4th Plan, for the first time, problems related to environment received Government's attention. At the initiative of the former Prime Minister of India, Mrs. Indira Gandhi, a National Committee on Environmental Planning and Co-ordination (NCEPC) was set up in 1972 following the Stockholm Conference, to identify and investigate the problems of preserving or improving the human environment in the country as well as to propose solutions for environmental problems. This High-level advisory body was charged, among others, with reviewing policies and programmes which have a significant bearing on quality of environment and advise Government on environmental management and to improve the human environment in the context of population growth and economic development. It was to advise and suggest on existing legislation and regulation and administrative machinery and also for [promoting and strengthening environmental research, education and awareness. The NCEPC in its existence of eight years (1972-80) provided a major thrust in environmental planning, approval of projects in selected sectors, human settlement planning, surveys of wetlands and spread of environmental awareness and research.

Agricultural output during the 4th Plan reached a new high with successful research in plant breeding, using foreign genetic material, and use of high-yield (HY) varieties of cereal seeds. Importance of irrigation and intensive use of sub-soil water in many areas was realised. Greater demand for and increasing the use of chemical fertilisers, insecticides and other inputs. The 1973-74 targets for food grain production was set at 129 mt. Industrial growth, notably, in steel and aluminium, a wide range of machine tools, industrial machinery, electrical and transport equipment, fertilisers, drugs, and pharmaceuticals, cement, minerals and petroleum production increased. There was also a large increase in the manufacturing capacity for power generators. These contributed to the strengthening of the industrial structure and valuable potential for sustained industrial growth was created.

Fifth Five-Year Plan (1975-80): The Fifth Plan was formulated in light of two problems -_inflationary pressure and worsening BOP position due to steep rise in prices of imported oil & other materials including foodgrains. Escalation in costs, higher outlays on public consumption and non-development expenditure led to an erosion of resources for the Plan resulting in staggering of programmes owing to diminution in the size of investment in real terms.

Sixth Five-Year Plan (1980-85): The 6th Plan was prepared as a perspective plan (1980-81 to 1994-95) visualising accelerated progress towards removal of poverty, generation of gainful employment and technological and economic self-reliance. The 6th Plan continued with the objective of growth, modernisation, self-reliance and social justice.

The major objectives of the Sixth Plan were:

- (i) Achieving a higher growth rate of economy in the past.
- (ii) Moving towards significant reduction in the present disparities of income and wealth.
- (iii) Ensuring the country's continued progress towards self-reliance.
- (iv) Significant reduction in unemployment.

- (v) Appreciable rise in the standard of living of the poorest sections of population.
- (vi) Provision by State of some of the basic needs such as clean drinking water, adult literacy, elementary education, health care, rural roads, rural housing for the land less and minimum services for the urban slums.

In the beginning of the 6th plan, in recognition of the need for a fresh and comprehensive look at the administrative and legislative aspects of environmental protection, the Government of India constituted a High-Power Committee under the chairmanship of Shri N.D.Tiwari, former Deputy Chairman, Planning Commission. The Committee expressed the need for creation of a separate Department of Environment at the Centre to spearhead the role that environmental conservation must play for sustainable national development. The Department of Environment was thus created in 1980 to look exclusively after environmental issues. The Department was merged with the Forest Department (operating from the Ministry of Agriculture) into a full-fledged Ministry of Environment and Forests in 1985.

Seventh Five Year Plan (1985-90): The objectives of the 7th Plan continued to be growth, equality and social justice, self-reliance, improved efficiency and productivity. The emphasis was on policies and programmes which would accelerate the growth of foodgrain production, increase employment opportunities and raise income. Emphasis of rural employment through National Rural Employment Programme (NREP), Rural Landless Employment Guarantee Programme (RLEGP) and the Integrated Rural Development Programme (IRDP) to continue with better planning, closer monitoring and tighter organisation for effective implementation. Promotion and expansion of off-farm employment in agro-based rural industries and services. The Plan also had a component for raising the level of literacy to improve the functional relevance of education and to expand opportunities for acquiring new skills. The infrastructure sectors such as- power, energy, transport and communication to be improved and strengthened. Expansion and improvement in health care, nutritional support for vulnerable groups, fertility control, provision of clean drinking water and sanitation and housing. Anti-poverty programmes through income generating schemes. Shift of a sizeable part of the rural population from agriculture to secondary and tertiary sectors for protection and improved status of the under privileged.

Major Programmes of the Seventh Plan (1985-90):

There was considerable increase in the total area brought under afforestation programme. Block plantations, strip plantations, and farm forestry were carried out. Plan funds were made available through State Forest Departments. A National Wastelands Development Board (NWDB) was set up in June 1985 with the principal aim of reclaiming wastelands through a massive programme of afforestation activities with people's participation. To ensure an area-specific approach on fuelwood and fodder, a new centrally sponsored scheme was initiated from 1988-89. This scheme was to cover the watersheds in the districts included under the National Watershed Development Programme of the Department of Agriculture as to ensure integrated development of wastelands in the identified watershed. The scheme was to be implemented in 11 States. A centrally sponsored scheme for aerial seeding to cover vast tracts in a cost effective manner, especially in remote, inaccessible areas such as ravines and hills was introduced. Under the National Rural Employment Programme (NREP) and Rural Landless Employment (NLEP) and the Rural Landless Employment Guarantee Programme (RLEGP) carried out by the Department of rural Development, 25% of the funds were specially earmarked for the social sector forestry component, during the first four years of the 7th Plan.

However, the schemes had a number of deficiencies. The seeds for the programmes/schemes for afforestation were mostly collected without determining their quality. There were no specific plan of action for meeting fuelwood and fodder requirements, except for the continuance of the scheme for rural fuelwood plantation, which does not directly address the issue. The efforts at social forestry programme, were also largely departmental. The rural poor and tribals were given restricted access to resources for their basic sustenance.

The 5th, 6th and 7th Plan periods also became years of the “**Operation Flood Project**” also known as ‘**the White Revolution**’ dominating the animal husbandry sector for 20 years from 1970-1990. This single initiative through milk producers’ co-operatives, galvanised the milk industry into unprecedented growth to meet the requirements in urban areas. The milk production stagnant over post-independent years grew from an annual 3 million tons in 1947 to 22 million tons in 1972 and to 44 million tons in 1985. The Project was also successful to link the small and marginal farmers and landless labourers who constitute some 70% of all milk producers, to get a lion’s share of earnings directly (MOA, 1996).

Fodder development however, continued to be marginalised even in the 7th Plan - despite a growing concern over the acute scarcity situation. The devastating effects of the two year stretch of severe drought, almost country wide during the 1985-87 period focussed attention on the need for alternate strategies for feeding the livestock. The 7th Plan however, could not rise above the departmental approach of fodder development schemes (MOA, 1996). The 7th Plan also saw the establishment of a separate Department of Biotechnology (which was being implemented by the Department of Science and Technology) in 1986. The Ministry of Science and Technology also established a project on “National Centre for Medium Range Weather Forecasting” (NCMRWF) in 1989 with the prime objective of developing operational capability of medium-range (3 to 10 days in advance) weather forecasting capability.

Economic Liberalisation and the new Economic Policy, 1991

The early nineties witnessed major economic problems induced by fiscal imbalances and difficulties in the Balance of Payment (EAP, 1993). A structural adjustment process was begun to correct the imbalances and to bring down the BOP deficit. A new Economic Policy was prepared and with it began a process of economic reforms and liberalisation. The role of the Planning Commission was also redefined from a highly centralised planning system towards indicative planning, with emphasis on prioritisation of goals to reduce bottlenecks, and achieving higher growth rates. The Planning commission was also to play an integrative role and help in the development of a holistic approach to the policy formulation in critical areas of development.

The Eighth Five Year Plan and Sustainable Development (1992-97):

The 8th Five-Year Plan was launched in 1992, which was also the year of the United Nations Conference on Environment and Development (**UNCED**) also known as “**the Earth Summit**”. The UNCED resulted in the adoption of a number of International Conventions on Environment. These include the United Nations Framework Convention on Climate Change (**UNFCC**), the Convention on Biological Diversity (**CBD**), the Montreal Protocol on Ozone Depleting Substances (ODS), the **Forest Principles**, and the decision for a UN Convention to Combat Desertification (**UNCCD**), which was eventually adopted in 1994. The UNCED also agreed on a broad agenda for sustainable development of the world in the 21st century and prepared a blue-print giving the framework of objectives, activities and costs of implementation titled “**Agenda 21**”.

In the Eighth Five Year Plan (1992-1997), the role of the Planning Commission was redefined *viz.*, to move towards indicative planning which would outline the priorities and encourage a higher growth rate from a centralised planning system.

The 8th Plan had the benefit of positive growth rate of the 6th and 7th Plan which took the average GNP growth rate from an annual 3.5% to beyond 5.5%, with growing agricultural incomes, rising per capita consumption of food grains and other essential commodities and declining capital-output ratios and percentage of population under poverty line. The severe economic problems in 1990-91 made the 8th Plan to give special attention to infrastructure sectors such as power, transport and communications as a part of structural reforms. Accordingly, a process of economic liberalisation with changes in industrial and trade policies was initiated.

The 8th Plan was on building long-term strategic vision. The goal of sustainable development is reflected in the 8th Plan document, which underlines the significance of ensuring co-ordinated and integrated Governmental action for conserving nature and ensuring sustainable use of natural resources through a participatory process. The Plan recognised "Human Development" as the core of all developmental effort. The priority sectors of the Plan were health, education, literacy, and basic needs, including drinking water, housing and welfare programmes for the weaker sections. However, the severe economic problems limited public investment to socially critical areas focusing on human development and to give further impetus to the poverty alleviation programmes and to projects for diversification of agriculture, wasteland development, forestry, rural non-farm sector, rural infrastructure and housing and services.

The 8th Plan strategy was on employment generation that were environmentally friendly with the introduction of the Integrated Rural Development Programme (IRDP), the National Rural Employment Programme (NREP), the Rural Landless Employment Generation Programme (RLEGP). Nearly 16% of the urban India and 26% of the rural India did not have access to safe drinking water. The 8th Plan therefore, stressed on the need to extend the Urban and Rural Drinking Water Missions to 'no-source' villages (Ministry of Rural Development) and to small towns with population upto 20,000 (Ministry of Urban Development). The Rajiv Gandhi Drinking Water Mission was therefore launched to provide drinking water and sanitation facilities to these villages/hamlets. Programmes to conserve moisture through watershed development, catchment area treatment and integrated schemes for wasteland development including afforestation were initiated. The Integrated Rural Energy Programme for energy development in rural and urban areas with Central and State Plan funds, had during the 7th Plan covered about 750 Blocks. During the 8th Plan, the focus of this Programme was decentralised with a least cost mix of various energy options, covering conventional and non-conventional and renewable energy sources. The 8th Plan, with the introduction of the Constitutional Amendments, also proposed active participation of people in the planning and implementation through a decentralised approach. The Integrated Wastelands Development Scheme aimed at integrated land management based on village/micro watershed plans prepared after taking into account land capability, site conditions, and local needs of the people. The scheme aimed at enhancing people's participation in wastelands development programme. The Plan also recognised the role and involvement of Voluntary Agencies (VAs) and other people's institutions that are essential for effective micro-level participatory planning and implementation.

The 8th Plan document also articulated a policy on draught animals and that the overall improvement in the quality and work output of bovine population in the country. The issues of fodder needs and production were still not been adequately addressed (MOA, 1996).

The National Health Care Programme under the 8th Plan was based on popular participation with focus on disease prevention and health promotion. The problem of inadequate sanitation services in both rural and urban areas was of serious concern. As of 1988, about 54% of the urban population and almost 97% of the rural population did not have satisfactory sanitation facilities. The on-going health care and family welfare schemes were strengthened with the objective of minimising water/air borne communicable diseases, better health delivery services to the poor.

The environmental issues that were prominently taken up during the 8th Plan include:

- Conservation and sustainable utilisation of biodiversity in selected ecosystems including forests, mangroves, wetlands, coral reefs, mountain ecosystems.
- Afforestation, wastelands development, and conservation of soil and moisture and ensuring that water resources are not polluted.
- Control of industrial and related pollution with an accent on reduction and/or management of wastes, particularly hazardous wastes.
- Improving access to clean technologies.
- Tackling urban environmental issues.
- Strengthening scientific understanding of environmental issues, as well as structures for training at different levels, orientation and creating environmental awareness, resources assessment, water management problems.
- An alternative energy plan.

Ninth Five Year Plan (1997-2002):

The 9th Plan recognised that creation of employment opportunities and an increase of economic growth by themselves may not be sufficient to improve the living conditions of the poor. They would need to be accompanied by measures that enhance the social and physical conditions of existence. Primary education, primary health care, including the prevention and promotion of safe drinking water, nutrition and sanitation require heavy investment which has to be met with public funds. However, since the requirements of social infrastructure vary significantly across regions, the Plan recognised that greater decentralisation of decision-making powers than exists is desirable. Furthermore, recognising the localised nature of these essential sources, the Plan recommended that it is desirable that the control over operation and maintenance of facilities should be in the hands of people's institutions and local associations, with adequate resources being made available, either from the exchequer or through delegation of powers to raise such resources.

The various sector and cross-sector projects and programmes launched earlier on are continuing within the framework of the Ninth Five-Year plan. The Ninth Plan, which has an outlay of Rs.8592 billion, envisaged an average growth rate of 6.5 percent for the Plan period.

The major objectives of the Ninth Five Year Plan include:

- Ensuring the growth rate of the economy with stable prices.
- Providing the basic minimum services of safe drinking water, primary health-care facilities, universal primary education, shelter, and connectivity to all in a time-bound manner.

- Containing growth rate of population.
- Ensuring environmental sustainability of the development process through social mobilisation and participation of people at all levels.
- Empowerment of women and socially disadvantaged groups such as scheduled castes, scheduled tribes, and other backward classes and minorities as agents of socio-economic change and development.
- Promoting and developing people's participatory institutions like *Panchyati Raj* Institution, co-operatives, and self-help groups.
- Strengthen efforts to build self reliance.

WOMEN AND FIVE-YEAR PLANS²

The First Five Year Plan (1951-56): envisaged welfare measures for women. To spear head these, the Central social Welfare Board (CSWB) was established in 1953 which symbolised the welfare approach to women's problems. The CSWB was also reflective of the community development approach. Although rural women were within the purview of the community development programmes, they were not specifically catered to as a target population based on economic and other specific development related criteria. A large majority of poor rural women remained outside its purview.

Second Five-Year Plan (1956-61): Was closely linked with the overall approach of intensive agricultural development. The welfare approach to women's issues continued. The Plan recognised the need for the organisation of women workers. It also perceived social prejudices they suffered. The Plan recommended that women should receive maternity benefits and crèche for children of women workers. It also recommended speedy implementation of the principle of equal pay for equal work and provision for training to enable women to compete for higher jobs.

Third Five-Year Plan (1961-66): The largest share for social welfare was provided for expanding rural welfare services. The health programme concentrated mainly on provision of services for health, education, nutrition and family planning.

Fourth Five-Year Plan (1969-74): Continued the emphasis on women's education. The basic policy was to promote women's welfare with the family as a base of operation. The outlay on family planning was stepped up to reduce the birth rate from 45 to 25 per thousand through mass education. High priority was accorded to immunisation of pre-school children and supplementary feeding for children, expectant mothers and nursing mothers.

Fifth Five-Year Plan (1974-79): Emphasised the need to train women in need of income and protection. It also recommended a programme of functional literacy to equip women with skills and knowledge to perform the functions of child care, nutrition, health care, home economics, etc. This Plan coincided with the International Women's Decade. A Committee on the Status of women in India (CSWI) was constituted for a comprehensive examination of all questions relating to the rights and status of women in the context of changing social and economic conditions in the country and problems relating to the advancement of women. The Report stated that the dynamics of social change has adversely affected a large section of women and had created new imbalances and disparities such as: declining sex ratio, lower expectancy of life, higher infant and maternal mortality, declining work participation, illiteracy and rising migration.

² Source: National Perspective Plan for Women 1988-2000 AD, Ministry of Youth Affairs, Sports, Women and Child Development, GOI.

The CSWI Report led to a debate in the Parliament and to the birth of a new consciousness of women as critical inputs for material development rather than as targets of welfare policies. It was also realised that constitutional guarantees of equality would be meaningless and unrealistic unless women' right to economic independence is acknowledged and as contributors to the family and national economy is improved.

A major outcome of the CSWI Report was the National Plan of Action (1976) for Women. The Plan identified areas of health, family planning, nutrition, education, employment, legislation and social welfare for formulating and implementing programme for women and called for planned intervention to improve the conditions of women in India. The Plan also led to the setting up of the "Women' Welfare and Development Bureau" in 1976 under the Ministry of Social Welfare.

In 1977-78, as an exercise for the 6th Five-Year Plan, the Government appointed a Working Group on Employment of Women. This Group devoted a whole chapter on women and Development. For the first time, a shift was perceived from welfare to developmental approaches for women. The 6th Plan also recognised lack of women' access to resources as a critical factor impeding their development. The step of providing joint 'pattas' (Titles) to men and women were initiated.

Seventh Five-Year Plan (1985-90): The Seventh Five-Year Plan continued the efforts initiated in the 6th Plan focussing on generating awareness about women' rights and privileges and training them for economic activity and employment. Women' access to critical inputs and productive resources such as land (joint title or *patta* scheme initiated in the 6th Plan period) were expanded in the 7th Plan to include support through micro-credit, marketing, training in skills/management and technology. Another salient and crucial recognition was the need for organisation of women workers and Unions that could improve legal services to safeguard rights, reduce occupational and health hazards. The total outlay on women-specific schemes in the 7th Plan was 2.4% of the total outlay.

Eighth Five-Year Plan (1992-97): The Government of India is implementing over 27 schemes for women through various departments and ministries - Rural Development, Labour, Education, Health, Science & Technology, Welfare, Women and Child Development, etc.

C. Plan Programmes on Afforestation through Successive Plans³

S.N	Plan Period	Year	Area Afforested (in mha)	Cumulative (in mha)
1.	First	1951-56	0.05	0.05
2.	Second	1956-61	0.31	0.36
3.	Third	1961-66	0.58	0.94
4.		1966-69	0.45	1.39
5.	Fourth	1969-74	0.71	2.10
6.	Fifth	1974-79	1.22	3.32
7.		1979-80	0.22	3.54
8.	Sixth	1980-85	8.86	17.05
9.	Seventh	1985-90	0.75	17.80
10.		1990-91	1.15	18.95
11.	Eighth	1992-97	7.95	26.90
12.	Ninth	1997-2002	1.48 (upto 1998)	28.38 (upto 1998)

Source: NFAP, MOEF, GOI, 1999

³ National Forestry Action Programme, Ministry of Environment and Forests, Government of India

ASSOCIATED PROGRAMMES OF THE GOVERNMENT OF INDIA TO COMBAT DESERTIFICATION

A. SOCIAL SECTOR PROGRAMMES

1. Swayamsiddha (formerly Indira Mahila Yojana)

The scheme was launched by the Government of India for the holistic empowerment of women and to develop empowered women who will :

- Demand their rights from family, community and government.
- Have increased access to and control over material, social and political resource.
- Have enhanced awareness and improved skills.
- Be able to raise issues of common aim through mobilisation and networking.

It is premised on recognition of the fact that empowerment is a multifaceted process. It seeks to achieve this by the following objectives:

- To generate awareness among women by disseminating information and knowledge, so as to bring about an attitudinal change.
- To help women achieve economic strength through micro-level income generating activities, and
- To establish convergence of various services such literacy, health, non-formal education, rural development, water supply, entrepreneurship etc.

The activities of Swayamsiddha are structured to achieve :

- Formation of stable women's group at the block level;
- Identification of existing active women's groups under other programmes and establishing linkage of all active women's group in the block;
- Providing training to group members, master trainers and facilitators - (animators);
- Convergence of all government programmes at various levels;
- Involvement of women in plan process, generating awareness among them by ensuring constant flow of information;
- Promote income generation activity among its members;
- Establishment of IMBS as an active and self sustained entity;
- Formation of SHGs for women;
- Encourage thrift and savings; and
- Increase in capacity building & awareness generation.

The Scheme will be implemented by the State Governments through the identified Nodal Department at the State level an implementing agencies at the Block level (PIAS). A PIA may be any appropriate agency, Governmental or non-governmental including district/ intermediary level panchayat institutions as also NGOS or government departments/organisations. The PIAs will prepare block specific projects, integrating various elements at that level.

In order to achieve these objectives, the basic thrust of the Scheme is the formation of Self Help Groups (SHGs) of women in villages at anganwadi level and to encourage as an entry point thrift and savings activities. It would prepare women to participate in planning, implementation and monitoring activities of village level bodies such as

panchayats, zilla parishads, village committees and samitis. Women in the Self Help Groups at the grass root level under this strategy would have access to various development programmes. These SHGs will be federated at the village and block levels.

2. Reproductive and Child Health Programme (RCH)

Under RCH, rural areas of the entire country are covered for primary health care. The main highlights of the RCH Programme are :

- The programme integrates all interventions of fertility regulation, maternal and child health with reproductive health of both men and women.
- The services provided are client centred, demand driven, high quality and based on the needs of the community arrived at through decentralised participatory planning and a target free approach.
- The programme envisages upgradation of the level of facilities for providing various interventions and quality of care.
- The programme improves access of the community to various services which are commonly required to provide facilities for MTP, counselling and IUD insertion.
- The programme aims at improving the outreach of services, particularly for the vulnerable groups of population who have till now substantially been left out of the planning process.

3. Programmes on Literacy

	Name of the Programme	Objectives
i.	Operation Blackboard	The scheme seeks to bring about both qualitative and quantitative in primary school education.
ii.	Teacher Education	The scheme envisages setting up of DIETs, in each district to provide academic and resource support to elementary education teachers and non-formal and adult education instructors.
iii.	Non-formal Education	A large group of children remain outside the formal system of education due to various socio-economic constrains. A programme of non-formal education for children of 6-14 age group of children is implemented. These include dropouts of formal schools, children from habitats without schools, working children, children who assist in performing domestic chores like fetching fuel, fodder, water, grazing cattle, etc and girls who are unable to attend formal schools.
iv.	Shiksha Karmi Project	Enrolment of girls, their attendance and retention in primary schools is one of the serious challenges in achieving Universalisation of Elementary Education in Rajasthan. The SKP aims at addressing these through decentralised initiatives involving the community. At the grassroot level, Panchayat Samities, Shiksha Karmi Sahyogis, subject specialists of NGOs, Shiksha Karmis and the village community constantly interact with each other to achieve the aims of the project.
v.	District Primary Education Programme	The DPEP mainly aims at providing access to primary edn. for all children, reducing primary dropout rates to less than 10 Per cent, increasing learning achievement of primary school Students by atleast 25 per cent, and reducing the gap among Gender and social groups to less than 5 per cent. The programme components incl: construction of classrooms And new schools, opening of Non-formal/Alternative Schooling Centres, appointment of new teachers, setting up of Block Resource Centres/Cluster Resource Centres, teacher training, development of teaching - learning material, research based interventions, special interventions for education of girls, SC/ST

etc The components of integrated education to children with disability and a distance education component for improving teacher training have also been incorporated in the programme.

vi. Mahila Samakhya Programme (MSP)

Mahila Samakhya Programme (MSP) is directly related to the employment of rural poor women through education. Under This programme a group of women called Sangha is formed at the village level which is supported by a Sahayogini (a cluster coordinator in-charge of 10 villages). This programme has a very efficient working arrangement and coordination between the rural women groups and the District Unit of the programme. The Sanghas address a wide range of issues relating to their livelihood, education, health, to assessing resources among others. The main objectives of the programme are as under :

- To enhance the self-image and self-confidence of women and thereby enabling them to recognize their contribution to the economy as producers and workers, reinforcing their need for participating in educational programmes;
- To create an environment where women can seek knowledge and information and thereby empower them to play a positive role in their own development and development of society.
- To establish a decentralized and participative mode of management, with the decision making powers developed to the district level and to Mahila Sangha which in turn will provide the necessary conditions for effective participation.
- To enable Mahila Ssangha to actively assist and monitor educational activities in the villages - including the primary school, Adult Education, Non-Formal Education Centres and facilities for continuing education.
- To provide women and adolescent girls with the necessary support structure and in informal learning environment to create opportunities for education.
- To set in motion circumstances for larger participation of women and girls in formal and non-formal education programmes, and to create an environment in which education can serve the objectives of women's equality.

vii. Adult Education

Under this scheme assistance is given to voluntary agencies in adult education under National Literacy Mission for achieving the objective of total eradication of illiteracy from people in the age group of 15 to 35 years. The scheme also has the objectives to ensure maximum participation of women and persons from backward and weaker sections making them aware of their legal and social rights through literacy; and to educate children between 9 to 14 years for whom no non-formal education facilities exist.

4. Scheme for welfare and development of scheduled castes, scheduled tribes, minorities and other backward classes

Some of these schemes include:

- Special Central Assistance to Special Component Plan for Scheduled Castes.
- Concessional finance to the poorer sections among the scheduled castes, safai karamcharis, other backward classes, minorities, and the disabled for taking up income generating activities through apex Finance & Development Corporations.
- Post Matric Scholarship for Scheduled Castes.
- Pre-Matric scholarship for the children of those engaged in unclean occupations and other backward classes.
- National Scheme for Liberation and Rehabilitation of Scavengers and their dependants.
- Pre-Matric and post-matric scholarships and other backward classes.

These are briefly explained below:

(i) Special Central Assistance (SCA):

This Central Scheme is the most important programme of the Ministry of Social Justice and Empowerment for the alleviation of poverty among scheduled castes people. The underlying objectives behind SCA which provides cent percent grant to States and Union Territories as an additive to their special component plans is that it would be used to give an added thrust to the development programmes for scheduled castes people with reference to their occupational pattern and the need for increasing the productivity of and income from their limited assets by taking up family oriented schemes for them. The SCA is used to fill the critical gaps and vital missing inputs in family-oriented income-generating schemes so as to make the schemes more meaningful and effective. This scheme was started with a token provision of Rs. Five crores. The State Governments and Union Territory Administrators are required to disburse Special Central Assistance to various sectors and agencies including Scheduled Castes Development Corporations, which are involved in the implementation of economic development programmes for scheduled castes. During 2000-2001, the Central assistance of Rs. 450.39 crores was released.

(ii) National Scheme for Liberation and Rehabilitation of Scavengers:

the National Scheme of Liberation and rehabilitation of Scavengers and their dependants assists the scavengers towards their rehabilitation in alternate dignified occupations. Whereas 100% Central assistance is provided for training of scavengers towards their rehabilitation, the unit project cost is upto Rs 50,000/-, which is financed by way of subsidy upto Rs. 10,000/-, beside margin money loans and bank loan. The concept of Sanitary Marts have provided entrepreneurial opportunities to scavengers and are now functioning profitably in the States of Andhra Pradesh, Tamil Nadu and Uttar Pradesh. During 2000-2001, Rs. 60.92 crores were released to the States for implementation of the scheme.

(iii) Educational Support to the Students of Scheduled Caste and Other Backward Communities (OBCs)

(a) Post-Matric Scholarship for SC Students

The scheme was introduced in 1944-45 with the objective of providing financial assistance to students studying at post-matriculation level to enable them to complete their education. Beginning with a mere 114 students in 1944-45, the scheme is presently covering nearly 15 lakh students. During 2000-2001, Central assistance of Rs 114.15 crore was released.

(b) Pre-Matric Scholarships

Begun in 1977-78, this scheme is for educational development of those who are engaged in sanitary occupations - scavenging of dry latrines, tanning, flaying, and sweeping with traditional links with scavenging. The scheme provides for scholarship upto Lower school, Middle and Higher classes.

(c) Pre-Matric Scholarships for OBCs:

Scholarships are also awarded to students at the pre-matric level (upto Class X) whose parents/guardians income is low. The scholarship is applicable to institutions recognised by the concerned State Governments. The Central assistance is to the extent of 50%. An amount of Rs 6 crore was released under the schemes to the States of Karnataka, Tripura, Tamil Nadu, and Manipur in 2000-2001.

(d) Post-Matric Scholarship for OBCs:

The Scheme provides 100% financial assistance to OBC students at post matriculation/post secondary stage to enable them to complete their education. An amount of Rs. 8.99 crore was released under the scheme to Andhra Pradesh, Karnataka, Goa, Assam, J&K and U.P. in 2000-2001.

5. Other Important Social Sector Schemes

(i) National Social Assistance Programme (NSAP): The NSAP has three components, namely National Old Age Pension Scheme, National Family Benefit Scheme and National Maternity Benefit Scheme.

a) National Old Age Pension Scheme : Under this scheme, Central Assistance is available to a destitute in the sense of having little or no regular means of subsistence from his/her own sources of income or through financial support from family members or other sources.

b) National Family Benefit Scheme : Central assistance is available under this scheme for a lump sum family benefit for households below the poverty line on the death of the primary breadwinner in the bereaved family subject to the following conditions :

c) National Maternity Benefit Scheme : Under this scheme, Central assistance is provided as a lump sum cash assistance to women of households below the poverty line, subject to the condition that the maternity benefit is restricted to pregnant women for up to the first two live births provided they are of 19 years of age and above and that the beneficiary belongs to a household below the poverty line as per criteria prescribed by the Government of India.

(ii) Jawahar Gram Samridhi Yojana (JGSY)

All works that result in the creation of durable productive community assets can be taken up under the programme as per the felt need of the area / people by the village panchayat. The works that can be taken up under the programme are :

- Infrastructure for SCs/STs habitations
- Infrastructure required for supporting agricultural activities in the village panchayat
- Community infrastructure for education, health and roads
- Other social, economic and physical infrastructure

B. ASSOCIATED INCOME GENERATING SCHEMES BEING IMPLEMENTED BY VARIOUS MINISTRIES/DEPARTMENTS

(1) SCHEMES OF THE MINISTRY OF RURAL DEVELOPMENT: The Ministry of Rural Development is implementing programmes and schemes for providing sustainable income through self-employment programme and also schemes having avenues for supplemental income earning opportunities through wage employment programme like Jawahar Gram Samaridhi Yojana (JGSY), Employment Assurance Scheme (EAS), Construction of Rural Roads, etc.

(i) Swarnjayanti Gram Swarozgar Yojana (SGSY)

This Ministry has integrated all its programme for capacity building and self-employment to take up a holistic programme covering all aspects of self-employment such as organisation of poor into self-help groups, training, credit, technology, infrastructure and marketing. The new programme is known as Swarnjayanti Gram Swarozgar Yojana (SGSY). The objective of SGSY is to bring the assisted families (Swarozgaris) above the poverty line in three years by providing them income generating assets through a mix of bank credit and Government subsidy. Salient features of the scheme are as under :

- Swarnjayanti Gram Swarozgar Yojana aims at establishing a large number of micro-enterprises in the rural areas, building upon the potential of the rural poor. It is rooted in the belief that rural poor in India have competencies and, given the right support can be successful producers of valuable goods/services.
- The assisted families (henceforth known as Swarozgaris) may be individuals or groups (Self-Help Groups). Emphasis will be on the group approach.
- The objective under SGSY is to bring every assisted family above the poverty line in three years.
- Towards this end, Swarnjayanti Gram Swarozgar Yojana (SGSY) is conceived as a holistic programme of micro-enterprises covering all aspects of self-employment, viz. Organisation of the rural poor into Self-Help Groups and their capacity building, planning of activity clusters, infrastructure build up, technology, credit and marketing.
- In establishing the micro-enterprises, the emphasis under SGSY is on the cluster approach. For this, 4-5 key activities will be identified for each block based on the resources, occupational skills of the people and

availability of markets. Selection of key activities will be with the approval of the Panchayat Samitis at the block level and the DRDA/ZP at the District level. The major share of SGSY assistance will be in activity clusters.

- SGSY will adopt a project approach for each key activity. Project reports will be prepared in respect of identified key activities. The banks and other financial institutions will be closely associated and involved in preparing these project reports, so as to avoid delays in sanctioning of loans and to ensure adequacy of financing.
- The existing infrastructure for the cluster of activities will be reviewed and gaps will be identified. Critical gaps in investments will be made under SGSY subject to a ceiling of 20% of the total programmes allocation for each district. This amount will be maintained by DRDAs as 'SGSY - Infrastructure Fund' and which can also be utilized to generate additional funding from other sources.
- The effort under SGSY is to cover 30% of the poor in each block in next five years through an efficient programme. In planning of the key activities, care would be taken to ensure that the maximum numbers of panchayats are covered without jeopardising the quality of the programme.
- SGSY's focus is on Group approach. This would involve organisation of the poor into Self-Help Groups (SHGs) and their capacity building. Efforts would be made to involve women members in each SHG. Besides, exclusive women groups will be continue to be formed. At the level of the Block, at least half of the groups will be exclusively women groups. Group activity will be given preference and progressively, majority of the funding will be for Self-Help Groups.
- The Gram Sabha will authenticate the list of families below the poverty line identified in the BPL census. Identification of individual families suitable for each key activity will be made through a participatory process.
- SGSY is a credit-cum-subsidy programme. However, credit will be the critical component in SGSY, subsidy being only a minor and enabling element. Accordingly, SGSY envisages a greater involvement of the banks. They will be involved closely in the planning and preparation of projects, identification of activity clusters, infrastructure planning as well as capacity building and choice of activity of the SHGs, selection of individual Swarozgaris, pre-credit activities and post-credit monitoring including loan recovery.
- SGSY will seek to promote multiple credit rather than a one-time credit 'injection'. The credit requirement of the Swarozgaris will be carefully assessed. They will be allowed and, in fact, encouraged for increasing their credit intake over the years.
- SGSY will seek to lay emphasis on skill development through well-designed training courses. Those, who have been sanctioned loans will be assessed and given necessary training. The design, duration of training and the training curriculum would be tailored to meet the needs of the identified activities. DRDAs will be allowed to set apart upto 10% of the SGSY allocation on training. This would be maintained as 'SGSY - Training Fund'.
- SGSY will ensure upgradation of the technology in the identified activity clusters. The technology intervention will seek to add value to the to the resources, including processing of the locally available material from natural and other resources for local and non-local market.
- SGSY will provide for promotion of marketing of the goods produced by the SGSY Swarozgaris. This would involve providing of market intelligence, development of markets, consultancy services, as well as institutional arrangements for marketing of the goods including exports.
- Subsidy under SGSY will be uniform at 30% of the project cost, subject to a maximum of Rs.7500/-. In respect of SC/STs, however, these will be 50% and Rs. 10,000/- respectively. For groups of Swarozgaris (SHGs), the subsidy would be at 50% of the cost of the scheme, subject to a ceiling of Rs. 1.25 lakh. There will be no monetary limit on subsidy for irrigation projects. Subsidy will be back-ended.
- SGSY will particularly focus on the vulnerable groups among the rural poor. Accordingly, the SC/STs will account for at least 50% of the Swarozgaris, women for 40% and the disabled for 3%.
- SGSY will be implemented by the DRDAs through the Panchayat Samities. The process of planning, implementation and monitoring would integrate the banks and other financial institutions, the PRIs, NGOs, as well as technical institutions in the district. DRDAs will be suitably revamped and strengthened.

- 15% of the funds under SGSY will be sent apart at the national level for projects having a far reaching significance and which can also act as indicators of possible alternative strategies to be taken up in conjunction with other departments or semi-government or international organizations. This would include initiatives to be taken in the individual districts or across the districts.
- The central allocation earmarked for the States will be distributed in relation to the incidence of poverty in the States. However, additional parameters like absorption capacity and special requirement will be also taken into consideration during the course of the year.

(ii) Jawahar Gram Samridhi Yojana (JGSY) : Jawahar Gram Samridhi Yojana was launched on April 1, 1999 by restructuring the erstwhile Jawahar Rozgar Yojana (JRY). The scheme is being implemented with the objectives of creation of demand driven community village infrastructure including durable assets to increase the opportunities for sustained employment and also to generate supplementary employment for the unemployed poor in the rural areas. The wage employment is given to below poverty line families. The programme is being implemented through Village Panchayats which receive funds from DRDAs/Zila Parishads directly. All works that result in the creation of durable productive community assets can be taken up under the programme as per the felt need of the area/people by the village panchayat. Since inception upto 1997-98, the scheme (in various forms) was able to generate a total of 70003.32 lakh mandays of employment.

(iii) Employment Assurance Scheme: The Employment Assurance Scheme is a wage employment programme being implemented at the District level throughout the country. The primary objective of the Employment Assurance Scheme is to provide gainful employment during lean agricultural season in manual work to all able bodied adults in rural areas who are in need and desirous of work, but cannot find it. The secondary objective is the creation of economic infrastructure and community assets for sustained employment and development. The scheme is operative in all the rural blocks of the country. The list of works is finalized by the Zila Parishads in consultation with the elected representatives of the area. During 1999-2000, employment of 1202.62 lakh mandays was generated under the scheme.

(iv) Area Development Programmes like IWDP, DPAP & DDP:

One of the main objectives of the area development programmes, namely, Integrated Watershed Development Programme (IWDP), Drought Prone Area Programme (DPAP) and Desert Development Programme (DDP) is to promote the economic development of the village community and improve the economic conditions of resource poor and disadvantaged section of the society through creation, widening and equitable distribution of the resources and increase the employment opportunities. All the three Schemes are being implemented in the desert and drought prone areas. The Ministry of Rural Development has prescribed a common set of guidelines called the 'Guidelines for Watershed Development' for the implementation of these programmes. These programmes have vast employment potential for the people living in the desert and drought prone areas of the country and have direct impact over the economic development of the poor people living in the most difficult areas of the country.

(3) SCHEMES OF THE DEPARTMENT OF WOMENT & CHILD DEVELOPMENT

(i) Support to Training and Employment Programme for Women (STEP)

This programme launched in 1997 seeks to provide updated skills and new knowledge to poor and assetless women in the traditional sectors such as agriculture, animal husbandry, dairying, fisheries, handlooms, handicrafts, kahdi and village industries, sericulture, social forestry and wasteland development for enhancing their productivity and income generation. This would enhance and broaden their employment opportunities

including self-employment and development of entrepreneurial skills. Women beneficiaries are organised into viable and cohesive groups or co-operatives. A comprehensive package of services such as extension inputs, market linkages, etc. are provided besides linkage with credit for transfer of assets. Since the inception of the programme more than 4.9 lakh women have been covered under 96 projects in different parts of the country.

(ii) Distance Education for Women's Development & Empowerment

Self-Help Groups have emerged as one of the major strategies for women's empowerment. Sustainability of the majority of these groups was major problem and one of the prime reasons for that was the lack of a proper training strategy. In order to address some of these critical areas of concern, this Scheme was launched in 2000. The Scheme entails a certificate course from Indira Gandhi National Open University (IGNOU) to train a large mass of trainers from amongst village level implementers of the projects, their supervisors and district level functionaries. Such trainers after their successful participation in the programme, would be able to guide suitable group formation in their areas. This Scheme is jointly undertaken by the Department of Women and Child Development, IGNOU and ISRO.

(iii) Condensed Course of Education for Adult Women

The scheme of Condensed Course of Education for Women was started by the Central Social Welfare Board during the year 1958 with the objective of providing basic education and skills to needy women and also to benefit widows, destitute deserted women and also those belonging to economically backward classes. Under this scheme, grant is given to voluntary organisations for conducting courses of two-year duration for preparing candidates for primary, middle and matric level examinations and one-year duration for matric failed candidates. During the year 2000-2001, grants amounting to Rs 247.47 lakhs have been sanctioned for conducting 443 courses to benefit 11, 225 women candidates.

(iv) Vocational Training Programme

Based on the National policy on skill development for girls and women, the Central Social Welfare Board had started the Scheme of the vocational Training Programme in the year 1975 to train women in marketable trades and also to upgrade their skills in order to enable and empower them to access remunerative employment opportunities. The Training programme is organised in rural, tribal, backward, urban slum areas through voluntary organisations in the traditional and non-traditional trades such as Computer training, Community Health, Paramedical Vocations, Typing and Shorthand to enable them to get employed in Offices. Special emphasis is also laid on implementing this programme in After-Care Homes, Women Cell of Jails, and other custodian institutions. The organisations are identified through State Social Welfare Advisory Boards in all States and UTs. Implementation is monitored through field machinery. The scheme has been instrumental in providing job opportunities to a large number of needy women and thereby enhancing their socio-economic status.

(v) Awareness Generating Projects for Rural & Poor Women

The Awareness generation Programme aims to identify the needs of rural and poor women and to generate awareness among them about their status in the family and society and to activate them to work for achieving their rights and to deal with social issues. Since 1993-94, special emphasis has been given to participation of women in Panchayati Raj Institutions and their role in promoting national integration and communal harmony. Some of the Schemes such as the Rashtriya Mahila Kosh and the Mahila Samridhi Yojana have also been included in this Scheme to motivate rural women towards self-reliance.

(vi) Socio-Economic Programme

The socio-economic Programme of the Central Social Welfare Board endeavours to provide employment opportunities on full or part time basis to destitute women, widows, deserted and physically handicapped to supplement their meagre family income. In addition, women entrepreneurs are encouraged to exhibit and sell their products through Exhibition-cum-Melas organised by the Boards at the District level. Voluntary organisations are encouraged to set up Production Units, which can provide employment on full or part time basis to women. Project proposals are cleared by District Industrial Centres, KVICs, etc who look into the viability of the projects. A grant is provided by the Central Social Welfare Board to facilitate setting up a production unit by the grantee institution. The grant is finalised on case-to-case basis subject to a limit of Rs 3 lakhs.

OTHER PROJECTS/SCHEMES INCLUDE:

- Education Work for Prevention of Atrocities on Women
- Family Counselling Centres
- Maintenance of Working Women's Hostels
- Short Stay Home for Women and Girls

B. PROGRAMMES FOR CONSERVATION OF NATURAL RESOURCES

1. CONSERVATION OF BIODIVERSITY

The main strategy for conserving this unique bio-diversity has been through the protection of viable areas of habitats and ecosystems, mainly through the creation of the Protected Area Network (PAs) of national parks, sanctuaries, biosphere reserves, identified wetlands and coastal areas. The country has a total of 521 Protected Areas, the state-wise break-up is given in Table 6.5.

(i) Protected Area Network (PAs)

In the past 25 years, the network of protected areas (PAs) has expanded from 10 national parks and 125 wildlife sanctuaries to 85 national parks and 447 wildlife sanctuaries as protected areas (as on 1999). Within these PAs, 23 tiger reserves covering a total area of 3.30 m ha have been established. These 521 PAs together cover nearly 15 m ha, which is about 5 percent of the country's geographical area and about 23 percent of forest area (MOEF,1999). These are not only repositories of natural biological diversity but have also helped in combating desertification.

(ii) Biosphere Reserves: The main strategy for conserving biodiversity has been through protection of viable areas of habitats and ecosystems by designing such areas as Protected Areas (PAs). Apart from the 521 protected Areas, a total of twelve Biosphere Reserves with a basic objective to conserve the biodiversity of plants, animals and microorganisms have been established. These are: (i) Nilgiri, (ii) Nanda Devi, (iii) Great Nicobar, (iv) Gulf of Mannar, (v) Sundarbans, (vi) Nokrek, (vii) Manas, and (viii) Simplipal, (ix) Dibru-Saikowa, (x) Dehang Debang, (xi) Pachmari, and (xii) Kanchanjunga. These aim not only at protecting representative ecosystems, but also serve as laboratories for conservation and for evolving alternate models of development. The Ministry of Environment and Forests assists the State Governments in conservation and management of these Biosphere Reserves. A set of guidelines have been brought out for conservation and management of biosphere reserves for wider circulation amongst various stakeholders.

(iii) Conservation of Wetlands: In addition, twenty one wetlands have been identified for scientific management and research and for providing habitat for important flora and fauna including migratory birds.

2. SPECIFIC SCHEMES FOR REVEGETATION OF DEGRADED LANDS AND WASTELANDS

(i) Area Oriented Fuelwood and Fodder Projects Scheme (AOFFPS)

The scheme is implemented with a view to augment production of fuelwood and fodder in the 229 identified fuelwood deficient districts of the country to meet the needs of the communities. The scheme was implemented on 50:50 sharing basis with the State Governments. The revised Ninth Plan allocation for the scheme is Rs. 200 crores (proposed physical target is 3.69 million ha). 25 projects have been sanctioned so far to the States in the Ninth Plan with a total outlay of Rs. 200.73 crores.

(ii) Conservation and Development of Non-Timber Forest Produce (including medicinal plants) Scheme (NTFP)

This scheme provides for financial assistance to the State Governments for increasing production of Non-Timber Forest Produce (NTFP) including Medicinal Plants. It has a special focus on tribal population for whom NTFP is an important source of livelihood. It is a 100% Centrally Sponsored scheme. The revised Ninth Plan allocation for the scheme is Rs. 80.50 crores (proposed physical target is 0.50 lakh ha). 35 projects have been sanctioned so far to the States in the Ninth Plan with a total outlay of Rs. 70.50 crores.

(iii) Tree and Pasture Seed Development Scheme: This is a 100% Centrally Sponsored Scheme. Till 1997-98 the basic objective of this scheme (called the Seed Development Scheme) was to generate quality seeds which would lead to the growth of healthy and better quality trees. Under this scheme, the State Governments were given financial assistance to develop facilities for collection, storage, testing, certification and distribution of quality seeds. The approved outlay of 8th Plan was Rs. 9 crores against which Rs. 7.81 crores was released. The scheme, with effect from 1998-99, is being implemented under the name of "Tree and Pasture Seed Development", to include fodder production which is an important component of afforestation programmes. Therefore, seed production of pasture grasses and legumes including selection of superior stands of endemic grasses, their collection, processing, storage and distribution will also be included in the new scheme. For funding, one-time central assistance will be provided to the States to meet non-recurring expenses while the State Governments will henceforth meet all recurring expenditure (salary, wages, TA training costs etc.). The revised allocation for the Ninth Five Year Plan for this scheme is Rs. 11.30 crores.

(iv) Plantations carried out under the Biosphere Reserve Programme

Biosphere Reserves (BRs) are protected areas of land and/or coastal environments wherein people are an integral component of the system. Together, they constitute a world-wide network linked by international understanding for exchange of scientific information. 12 biosphere reserves have been designated in the country till February, 2000. An amount of Rs.147.70 lakhs was provided during 1996-2000 for taking up plantation activities in the biosphere reserves in the country.

Box. Distribution of Free Seedlings Under Various Plan

During 1990-91, 1991-92 and the VIIIth Plan, 1270, 1419 and 5587 million seedlings respectively were distributed to the public for planting. During 1997-98 of IX Plan, 1033 million seedlings were distributed to people. Upto 1997-98, total number of seedlings distributed to people was 9309 million, notional area of which works out to be 4.65 million ha area, assuming 2000 seedlings to be planted per hectare. This has been included in the total area afforested as 2.8 mha.

Source: NFAP, 1999

PROGRAMMES FOR ECORESTORATION OF DEGRADED LANDS

(i) Swarna Jayanti Kunj under IAEPs : Swarna Jayanti Kunj Project (under IAEP Scheme)

To commemorate the 50th Anniversary of India's Independence, it was decided that each village may raise a cluster of 50 trees for promoting people's participation in the afforestation programmes. NAEB has provided financial assistance to the State Forest Departments during 1997-98 for this purpose, which would be utilised for raising seedlings of appropriate indigenous species for distribution through the village panchayats. The total expenditure incurred on the above activity during 1997-98 was Rs. 5.87 crores. The proposed plantations were to be completed by 15 August, 1998. Extension of time/revalidation of funds released in 1997-98 is being approved to the States that have asked for more time to complete the plantation work.

(ii) Grants-in-Aid Scheme: In tune with the philosophy of eliciting and nurturing people's participation, the Board provides financial assistance to Non-governmental organisations (NGOs) and Voluntary Agencies (VAs) for afforestation and tree planting activities on public/government/private lands. The scheme prescribes that at least 50% of the beneficiaries of the projects sanctioned should be from disadvantaged sections of the Society. The revised allocation for the Ninth Five Year Plan for this scheme is Rs. 10 crores. Central assistance of Rs. 4.50 crores, to 212 projects, has been provided so far under this scheme in the Ninth Plan period.

(iii) Association of Schedule Tribes and Rural Poor in Regeneration of Degraded Forest on Usufruct Sharing Basis Scheme

This centrally sponsored scheme is being implemented with the association of tribals and rural poor since 1992-93 (8th Plan) on a pilot basis. The objectives of the scheme are: (i) to improve forest based biomass resource base in degraded forest lands and to manage it on a sustained basis for the domestic needs of the identified communities; (ii) to involve local schedule tribes and other rural poor in protection and rehabilitation of degraded forests for maintenance of ecology of the area and for sustenance of local community; (iii) to provide gainful employment and a sustainable economic base to schedule tribes and other rural poor in the vicinity of their habitation. The scheme is being implemented through the State Forest Departments on the basis of projects formulated for the purpose in 14 states namely, Andhra Pradesh, Bihar, Gujarat, J&K, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Nagaland, Orissa, Rajasthan, Tripura and West Bengal, implemented this scheme in places dominant with tribal population. Apart from the wages for the work done by these people, they are benefited with intermediate products and sharing in final harvest. They are also entitled to collect minor forest produce, dead and fallen wood, and fodder. The impact of the scheme in the areas of implementation is good and many other States have also submitted project under this scheme.

Against the total outlay of Rs. 735 lakhs for the Eighth Plan, Rs. 735.66 lakhs were utilised. The physical target of 8330 ha was also achieved. For the Ninth Plan, Rs. 15.16 crores have been allocated for covering an area of 15,667 ha against which the amount released so far is Rs. 4.95 crores. The revised scheme has new components of Aided Natural Regeneration, Soil and Moisture Conservation, Entry Point Incentives and Training to Tribals. Twelve states namely Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Nagaland, Rajasthan and Tripura have submitted the project proposals under the scheme in the Ninth Plan. Orissa and West Bengal will continue to implement their projects to the extent not implemented during the VIII Plan as spill-over works.

C. OTHER MEASURES FOR DESERT AND DROUGHT-PRONE AREAS

(i) Indira Gandhi Nahar (Canal) Project (IGNP)

The Indira Gandhi Canal, in the northwestern part of Rajasthan, covers part of the Thar Desert. It provides irrigation to over 2.5 m ha of the Thar Desert, of which 1.2 m ha is the cultivable command area. Under an externally-aided (Japan Bank of International Programme (JIB) project, a total area of 33,725 ha, which includes sand dune stabilisation (16,114 ha), canal-side plantation (11,522 ha), road side plantation (603 ha), block plantation (2,279 ha) and pasture development (3,207 ha) has been covered since 1990-91 to protect IGNP against deposition of sand and to develop adjoining arid lands.

(ii) Initiatives for Drought-Prone Areas

The Central Ground Water Board (CGWB) in the Ministry of Water Resources has undertaken intensive surveys and exploration in drought-prone areas to delineate aquifers, which could provide sustainable water supply during prolonged drought periods. Ground water exploration is in progress in drought prone areas in the States of Rajasthan, Gujarat, Andhra Pradesh, Maharashtra, Madhya Pradesh, Karnataka, Uttar Pradesh, and Orissa.

In addition to the programmes mentioned above, the National Remote Sensing Agency (NRSA) with the co-operation of other agencies of the Department of Space (DOS) has carried out the following national programme for long-term drought mitigation:

(i) The Drinking Water Technology Mission prepared groundwater potential maps at district level, using multi spectral satellite data. This has helped in better identification of well sites for groundwater extraction.

(ii) The Integrated Mission for Sustainable Development (IMSD) of NRSA (being implemented by the Andhra Pradesh Government) for combating drought has evolved action plans by integrating satellite derived thematic information on watersheds with socio-economic data to provide action plans for development of food, fodder and water resources. In the first phase, 18 districts were covered. The action plans that were prepared are being implemented. In the second phase, action plans on watershed basis for about 126 districts are under preparation.

(iii) Under irrigation management projects in selected basins, satellite data has been used for purposes such as proposed irrigation development, identification of causes for poor performance of distributors and assessment of sediment in reservoir.

(iv) NRSA is also preparing land and water resource management maps and plans for 174 chronically drought-affected districts in the country.

Advertisements of the Central Ground Water Authority (CGWA) , Ministry of Water Resources on Training in Rain Water Harvesting. Top: Indian Express dated 12.1.2001 and Bottom: Indian Express dated 9.7.2001

CENTRAL GROUND WATER AUTHORITY
MINISTRY OF WATER RESOURCES
TRAINING ON RAIN WATER HARVESTING
PUBLIC NOTICE NO. 1/2001

Central Ground Water Authority is organising a one day training programme on Rain Water Harvesting for ground water recharge including Roof Top Rain Water Harvesting at the following places:

Places	Date	Venue	Contact Address
Ahmedabad	07.02.2001	Viksat, Thaltej, Tekra, Ahmedabad-380054. (Gujarat)	Regional Director, Central Ground Water Board, Swami Narain, College Bldg., Shah Alam Tolnaka, Ahmedabad-380022 (Gujarat) Tel-5320476, FAX-5329379
Bangalore	14.02.2001	Central Ground Water Board, 31st Cross, 11th Main, Block 4, Jayanagar, Bangalore-560011 (Karnataka)	Regional Director, Central Ground Water Board, 31st Cross, 11th Main, Block 4, Jayanagar, Bangalore-560011 (Karnataka), Tel-6631336, FAX-6348442.
Bhopal	14.02.2001	Central Ground Water Board, Block-1, 4th Floor, Paryawas Bhawan, Arera Hills, Jail Road, Bhopal-462011 (M.P.)	Regional Director, Central Ground Water Board, Block-1, 4th Floor, Paryawas Bhawan, Arera Hills, Jail Road, Bhopal-462011 (M.P.) Tel-557639, FAX-760090.
Bhubaneswar	14.02.2001	Central Ground Water Board, Bhujal Bhawan, Khandagiri Chak, NH-IV, Bhubaneswar-751030 (Orissa).	Regional Director, Central Ground Water Board, Bhujal Bhawan, Khandagiri Chak, NH-IV, Bhubaneswar-751001 (Orissa) Tel-470332, FAX-471902 (PP).
Calcutta	06.02.2001	Central Ground Water Board, Bhujalika, Sector-V, C.P. Block-6, Bidhan Nagar, Calcutta-700091 (W.B.)	Regional Director, Central Ground Water Board, Bhujalika, Sector-V, C.P. Block-6, Bidhan Nagar, Calcutta-700091 (W.B.) Tel-3673081, FAX-3573736 (PP).
Jodhpur	13.02.2001	Mathania, Jodhpur.	Officer Incharge, Central Ground Water Board, 22/2, Heavy Industrial Area, Near Jodhpur Milk Dairy, Jodhpur-342006 (Rajasthan) Tel-747614.

All Government organisations/Non-Government organisations/Resident Welfare Associations/Societies/Institutions/Schools/Industrialists/Individuals may contact at the address given above. **The training is free of charge.**

Chairman

HARVEST RAIN WATER TO RECHARGE GROUND WATER

SB 48300 dwp 4054/0108/2000

Advertisement of the Ministry of Water Resources in the form of Public Notice No. 1/2001 dated 12.1.2001

Advertisement of the Central Ground Water Authority (CGWA), Ministry of Water Resources on Training in Rain Water Harvesting: Indian Express dated 9.7.2001

CENTRAL GROUND WATER AUTHORITY (Constituted under section 3(3) of Environment Protection Act, 1986) MINISTRY OF WATER RESOURCES 1103, Ansal Bhawan, K.G. Marg, New Delhi-110001	
PUBLIC NOTICE NO. 13/2001	
Sub:- Training on Rain Water Harvesting including roof top rain water harvesting in Delhi.	
Attention:- Government Organisation/Resident Welfare Associations/Societies/Institutions/Schools/Hotels/Industrial Establishments /NGOs/ VOs/Individuals	
<p>Central Ground Water Authority is organising one day training programme on Rain Water Harvesting including Roof Top Rain Water Harvesting on 1st Aug, 2001 at New Delhi. All those who are interested may send their letter of request latest by 24th July, 2001, to the Member Secretary, Central Ground Water Authority, 1103, Ansal Bhawan, K.G. Marg, New Delhi-110001. FAX 3325063, on the following format - 1. Name & Designation ; 2. Organisation & Address; 3. Phone & Fax No. The number of seats for participants are limited and will be allotted on first come first serve basis. Acceptance of the request shall be intimated by post. The training is free of charge but no TA/DA and other facilities will be provided by the Authority.</p>	
VENUE Central Soil and Material Research Station (CSMRS Auditorium) Olof Palme Marg (Near IIT Delhi) New Delhi-110016	TIME 1000 hrs to 1700 hrs Chairman
HARVEST RAIN WATER TO AUGMENT GROUND WATER <small>davp 405404801</small>	

CENTRAL GROUND WATER AUTHORITY

(Constituted under section 3(3) of Environment Protection Act, 1986)

MINISTRY OF WATER RESOURCES

1103, Ansal Bhawan, K.G.Marg, New Delhi-110011

1.E.
29-6-01

PUBLIC NOTICE NO.12/2001

REGISTRATION OF GROUND WATER ABSTRACTION STRUCTURES IN GURGAON TOWN & ADJOINING INDUSTRIAL AREAS OF GURGAON DISTRICT, HARYANA

Whereas Central Ground Water Authority has notified "Gurgaon town and adjoining industrial areas of Gurgaon district, Haryana" for regulation of ground water development and management on consideration of depletion of ground water resource due to its over-exploitation and deterioration in ground water quality vide public notice no. 16/2000 published in the last week of December, 2000 in leading dailies. Under item 2 of the published notice, "the owners of all the existing ground water structures (wells, tubewells, borewells and any other form of ground water abstraction structure whether used for drinking or domestic, industry, irrigation or any other purpose) were directed to register their structures with the Authority on the prescribed proforma accompanied with the requisite fee". **The arrangement has been made for registration of ground water structures in the office of District Development & Panchayat Officer, Panchayat Bhawan, Gurgaon from 2-7-2001 to 1-10-2001. All Owners of ground water abstraction structures are requested to collect and submit the prescribed form and get their ground water abstraction structures registered within three months i.e by 1-10-2001.**

Any violation of the directions issued attracts penal action under the provision of section 15 of the Environment (Protection) Act, 1986.

Chairman

PRESERVE GROUND WATER TO SERVE HUMANITY

davp 4054/41/01

CENTRAL GROUND WATER AUTHORITY

MINISTRY OF WATER RESOURCES

1103, ANSAL BHAWAN, KASTURBA GANDHI MARG, NEW DELHI-110001

PUBLIC NOTICE No. 15/2001

6-9-01
1E

SUB- ADOPTION OF ROOF TOP RAIN WATER HARVESTING SYSTEMS

ATTN:- GROUP HOUSING SOCIETIES IN NCT, DELHI

Whereas it has been observed that water levels in major parts of NCT, Delhi have declined substantially due to over development of ground water resources and up coming of saline water has also been observed in several parts. Central Ground Water Authority has already declared South and South West districts as "Notified" considering the need for protection of ground water resources and regulatory measures are being implemented.

And whereas, the Authority with a view to protect and preserve the ground water resources from further depletion is promoting the techniques of Rain Water Harvesting including Roof Top Rain Water Harvesting for ground water recharge through organising training programme and mass awareness camps. Directives had also been issued in NCT Delhi to Institutions, residential societies, schools, hotels, industrial establishments in notified areas to adopt Roof top rain water harvesting system by 31st May, 2001.

Now, therefore, the Authority in exercise of its powers and functions conferred under section 5 of the Environment (Protection) Act, 1986, hereby directs all Group Housing Societies in NCT, Delhi except those societies located in Yamuna Flood Plain area or where water levels are within 8 metres below ground water level and who are exploiting ground water to adopt the Roof Top Rain Water Harvesting System in their premises. These system should be completed by 31st December, 2001. For any technical guidance and clarifications, Officer Incharge, State Unit Office, Central Ground Water Board, Gallery no. 18/11, Jamnagar House, Mansingh Road, New Delhi-110011. Ph. No. 3384355/3073093 may be contacted or website on Roof Top Rain Water Harvesting (www.cgwaindia.com) may be referred.

Any violations of the above issued directions attract penal action under section 15 of the Environment (Protection) Act, 1986, which shall include sealing of tubewell also.

Chairman

PRESERVE GROUND WATER TO SERVE HUMANITY

davp 4054/69/01

**Allocation for Major Land-based and Social-sector Programmes/Projects
included in the Eighth and Ninth Plan (in Rupees crores)**

Ministries/Schemes	Eighth Plan	Ninth Plan
I. Land-based Programmes :		
Agriculture :	967***	1020
i. National Watershed Development for Rainfed Areas (NWDRA)		
ii. Soil and water Conservation for enhancing productivity of degraded lands in the catchment of River Valley Projects and flood Prone Rivers	421***	600
iii. Watershed Development Projects in Shifting Cultivation Areas in North-east	32***	75
iv. Reclamation of Alkalis Soils	32.8***	18.75
v. Other Externally aided integrated Watershed Management Projects		
vi. National Watershed Fund	----	200
Environment and Forests (NAEB)		
i. Integrated Afforestation and Eco-Development Scheme (IAEPS)	200	247
ii. Area Oriented Fuelwood and Fodder Projects Schemes (AOFFPS)	158	135
iii. Conservation and Development of Non-timber Forest Produce (NTFP) including medicinal plants	55	80
iv. Grants-in-aid	6	Discontinued
v. Association of Scheduled Tribes and Rural Poor in Regeneration Degraded Forests on Unsufruct Sharing basis	7.35	15.00
Rural Development		
i. Integrated Afforestation and Eco-development Project Schemes	460	
ii. Fuelwood and Fodder Scheme		
iii. Development of MFP including Medicinal Plants		
iv. Integrated Wastelands Development Project (IWDP)	206.75	361.95
v. Tree Planting and Regeneration Component under Externally Aided Projects		
vi. Tree Planting and Regeneration Component under Rural Development Schemes (2% of outlays of JRY and EAS)	JRY 1570** & EAS 374.92@	
vii. Drought Prone Area Programme (DPAP)	448.26	465.00
viii. Desert Development Programme (DDP)	410.00	255.00
ix. Soil and Water Conservation, Watershed and Afforestation Projects of CAPART		
x. Soil and Water Conservation, Dry Farming, Development of Surface Water Storage and Afforestation outlays in the State Plans		
Ministry of Planning		
i. Western Ghats	191.03	
ii. Degraded Hill Areas	1235.62	
II. Social Sector Programmes :		
Ministries /Departments		
a) <i>Social awareness, security & empowerment of women and weaker sections of the society</i>		
Social Justice & Empowerment		
Construction of Girls Hostels for STs		
ii. Scheme of Ashram Schools		
iii. Education Complexes for ST Girls in the low literacy pockets of tribal areas		
iv. Grants-in-Aid (GIA) for Volunteer Organisations working for STs		
v. Assistance under 11(b) of Twenty Point Programme		
vi. Fifteen Point Programme for Welfare of Minorities		
vii. GIA to NGOs/Institutions under the Scheme of Pre-examination Coaching for Weaker Sections		

- based on Economic Criteria
- viii. GIA to NGOs/DRDA and IRCs under the scheme of assistance to disabled for purchase/fitting of Aids and appliances
 - ix. Assistance to VOs for Establishment and Development of Special Schools for disabled
 - x. Scheme of Assistance for VOs for Programmes relating to Aged
 - xi. GIA under the scheme of Assistance to P.R. Institutions/VOs/SHGs for construction of Old Age Homes
 - xii. Scheme of GIA for Assistance in the Field of Social Defense, and
 - xiii. GIA to VOs/Child Welfare Agency under Shishu Grih Scheme

National Social Assistance Programme (NSAP)

- i. National Old Age Pension Scheme
- ii. National Family Benefit Scheme
- iii. National Maternity Benefit Scheme
- iv. Balika Samridhi Yojna

b) Programmes for infrastructure development and employment generation

Rural Development

- i. Jawahar Gram Samridhi Yojna (JGSY)
- ii. Employment Assurance Scheme
- iii. Council for Advancement of People's Action and Rural Technology (CAPART)

Social Justice and Empowerment

- i. Scheduled Castes Development Co-operation (SCDCs)
- ii. National Scheduled Castes and Scheduled Tribes Finance and Development Co-operation (NSFDC)
- iii. National Safai Karmchari Finance and Development Co-operation (NSKFDC)

Department of Women and Child Development

- i. Rural Development and Employment Project
- ii. Indira Mahila Yojana (IMY)
- iii. Rashtriya Mahila Kosh (RMK)

c) Programmes for health nutrition, sanitation and safe drinking water

Department of Family Welfare

- i. Reproductive and Child Health Programme
- ii. Integrated Child Development Services (ICDS)

Rural Development

- i. Rajiv Gandhi National Drinking Water Mission (RGNDWM)
- ii. Centrally sponsored Rural Sanitation Programme and Accelerated Rural Water Supply Programmes (ARWSP)

d) Programme on literacy and preschool

Department of Education, MoHRD

- i. Operation Black Board
- ii. Teacher Education
- iii. Non-formal Education
- iv. Shikha Karmi Project
- v. District Primary Education Programme
- vi. Mahila Samakhya Programme (MSP)
- vii. Adult Education

* Includes two years (1990-91 and 1991-92) of extended Seven Five Years

** Rs. 1570 crore in 1995-96 in EAS, of which 50% was for watershed;

*** represents actual expenditure

@ Rs. 374.92 crores in JRY (excluding 1996-97) 50% of allocation was for watershed development

Source: Compiled by RN Kaul, Consultant.

Annex- 8

(Chapter 6, Section 6.7.1.2, Page 91)

Women Elected to the Parliament in Various General Elections in India

General Election	Year	Total no. of Seats	Total No. Contesting	Female		Male	
				No. Contesting	Elected	No. Contesting	Elected
First	1951	489	1874			Not Available	
Second	1957	494	1518	45	27	1473	467
Third	1962	494	1985	70	35	1915	459
Fourth	1967	520	2369	67	30	2302	490
Fifth	1971	520	2784	86	21	2698	499
Sixth	1977	542	2439	70	19	2369	523
Seventh	1980	542	5574	164	42	5406	500
Eighth			Not Available				
Ninth	1989	529	6160	198	27	5962	502
Tenth	1991	521	8699	325	37	8374	484
Eleventh	1996	543	13952	599	40	13353	503

Source: Election Commission of India.

Women Elected to the Panchayats as Members

States/UTs	Gram Panchayat		Panchayat Samiti		Zila Parishad	
	Total	Women	Total	Women	Total	Women
Andhra Pradesh	396,000	78,000	14,643	5054	1093	363
Arunachal Pradesh	5733	86	1205	39	77	--
Haryana	48,201	17,928	2418	807	-	101
Himachal Pradesh	18,258	6013	1661	558	254	84
Karnataka	78,476	34,073	3340	1343	919	335
Madhya Pradesh	443429	150181	9097	3109	946	319
Punjab	90,565	23,832	2441	326	274	89
Rajasthan	112,897	33,566	5257	1740	997	331
Sikkim	827	27	-	-	148	1
Uttar Pradesh	804,000	234,420	55750	18620	2230	756
West Bengal	61,398	21,742	9516	3202	664	227
A & N Islands	667	229	67	25	30	10
Daman & Diu	63	25	-	-	15	5

Women Elected to the Panchayats as Chairpersons

States/UTs	Gram Panchayat	Panchayat Samiti	Zila Parishad
Andhra Pradesh	15065	366	6
Arunachal Pradesh	-	-	-
Haryana	1994	38	5
Himachal Pradesh	970	23	4
Karnataka	1877	59	7
Madhya Pradesh	11,953	123	9
Punjab	158	47	5
Rajasthan	3064	80	10
Sikkim	1	-	-
Uttar Pradesh	19535	301	22
West Bengal	153	10	-
A & N Islands	-	-	-
Daman & Diu	6	-	-

Source: Department of Rural Development, Ministry of Rural Development.

Source of Inf.: National Perspective Plan for Women 1988-2000 AD, Ministry of Youth Affairs, Sports, Women and Child Development, GOI.

Land-Based Externally Aided Projects under Different Ministries

S. No.	Project	Donor	Year of launch	Achievement	
				Physical In ha*	Financial Rs. in million*
	Ministry of Agriculture				
1	I. Rainfed Farming System				
	Integrated Watershed Development Project (Hills) Phase I	IDA	NA	NA	2856.00
2	Phase II	EEC	1993	1999	9546.00
3	Doon Valley project	KFW		8506	387.00 #
	German (Kreditanstalt for Widdera-Ufbau) Assisted Watershed Project		1996	53633*	550.80
4	a) Karnataka		1992	NA	187.30
	b) Maharashtra				
	Comprehensive Watershed Development Project	DANIDA	1990-91	NA	417.20
	a) Tirnulvallei, Tamil Nadu	DANIDA	1994-95	NA	130.00
	b) Ramnathpuram	DANIDA	1990-91	NA	133.50
	c) Karnataka	DANIDA	1993-94	NA	132.50
	d) Koraput, Orissa	DANIDA	1997-98	NA	131.50
	e) Madhya Pradesh				
5	II. Soil and Water Conservation	German Government			110.00
6	Indo German Bilateral Project on Watershed (Training of staff)				
	Haryana Operational Pilot Project For Reclamation of Waterlogged and Saline Lands	Netherlands	1994-95	1028**	293.00
7	North Bengal Terai Development Project (Phase III)		1995-96		393.50
8	UP Sodic Land Reclamation Project	Netherlands	1993-94	47000	1365.80
1	Ministry of Rural Development		1993-94	300 villages*	978.00
2	Community Forestry Project, Haryana	World Bank		7872*	459.90
3	Watershed Development Project (being implemented by NTGCF)				
4	Allapady Wastelands Comprehensive Environment Conservation project, Kerala	EEC	1996	50700*	1768.90
	Capacity building and Knowledge Generation	CIDA			
	a) Andhra Pradesh				
	b) Orissa	OEFC	1999		381.60
5	Community Management of Natural Resources, Gujarat	DFID			2358.00
		DFID	1997	45000*	489.95
		EEC			
	Total				23558.50

*Total allocation of external assistance (not including State share) and targets

** Actual achievement and expenditure incurred so far

Source : M o E&F

Ongoing Projects

S.No.	Name of the Project	Implementing Agency	Funding Agency	Project Cost (Rs. In million)	Physical Targets (in '000 ha.)
	State Sector				
1	Maharashtra Forestry Project(2328-IN) 1992-93 to 1999-00	Maharashtra Government	World Bank	4315.10	369.10
2	Andhra Pradesh Forestry Project (2573-IN)) 1994-95 to 1999-00	Andhra Pradesh Government	World Bank	3539.20	355.00
3	Afforestation and Pasture Dev. Along Indira Gandhi Canal (ID-P-73)	Rajasthan Government	JBIC(Japan)	1075.00	61.50
4	Western Ghats Forestry Project 1992-93 to 1998-99 (1 year Extension under consideration)	Karnataka Government	DFID (U.K.)	842.00	61.00
5	Himachal Pradesh Forestry Project, Kullu Mandi 1994-95 to 1999-00	H.P. Government	DFID (U.K.)	139.20	11.00
6	Madhya Pradesh Forestry Project (2700-IN) 1995-96 to 1999-00	Madhya Pradesh Government	World Bank	2459.40	235.00
7	Integrated Gujarat Forestry Development Project (ID-P-112) 1995-96 to 2000-01	Gujarat Government	JBIC (Japan)	6085.00	230.00
8	Rajasthan Forestry Project, (ID-P-104) 1995-96 to 1999-00	Rajasthan Government	JBIC(Japan)	1391.80	55.00
9	Tamil Nadu Afforestation Project 1996-97 to 2001-02	Tamil Nadu Government	JBIC(Japan)	4992.00	405.00
10	Eastern Karnataka Afforestation Project 1996-97 to 2001-02	Karnataka Government	JBIC(Japan)	5655.40	471.00
11	Capacity Building Project for Participatory Management of Forests 1997-98 to 1998-99 (Yet to be completed)	Orissa Government	SIDA(Sweden)	85.00	19.00
12	Uttar Pradesh Forestry Project 1997-98 to 2000-01	U.P. Government	World Bank	2720.00	160.00
13	Punjab Afforestation Project 1997-98 to 2004-05 (Present loan for 4 years)	Punjab Government	JBIC(Japan)	4420.00	59.00
14	Kerala Forestry Project 1998-99 to 2001-02	Kerala Government	World Bank	1830.00	54.00
15	Capacity Building Project for Rehabilitation of Degraded Forests through Landscape Participatory Programme 1998-99 to 2000-01	KFRI, Kerala Government	AUSAID (Australia)	11.70	
16	Afforestation of Aravalli Hills 1992-93 to 1999-00	Rajasthan Government	JBIC (Japan)	1766.90	115.00
	Total			41327.70	
	Central Sector				
17	FREEP	MoEF	World Bank	1924.7	
18	Eco-development Project	MoEF	World Bank	2949.3	
	Grand Total			46201.70	

Source : Ministry of Environment and Forests, Government of India, New Delhi.

Ministry of Environment and Forests : Externally Aided Projects Completed

Sl. No.	Name of the Project	Aid Agency	Project Period	Project Cost in (Rs. million)	Actual Expdr. (Rs. in million)	Physical (in ha.)
1	Social Forestry Project Uttar Pradesh	World Bank	1979-80 to 1983-84	400.00	500.00	76000
2	Social Forestry Project Maharashtra	USAID	1982-83 to 1990	564.00	728.00	75726
3	Social Forestry project Andhra Pradesh	CIDA	1983-84 to 1990-91	383.80	427.60	45217
4	Social Forestry project Bihar	SIDA	1985-86 to 1991-92	538.50	486.00	53375
5	Social Forestry Project J&K and Haryana	World Bank	1982-83 to 1990-91	570.70	1061.90	186281
6	Social Forestry Project West Bengal	World Bank	1981-82 to 1990-91	347.50	640.00	242578
7	Social Forestry Project Karnataka	World Bank/ODA	1983-84 to 1991-92	1245.00	852.10	53351
8	Social Forestry Project Kerala	World Bank	1984-85 to 1992-93	595.10	896.80	131000
9	National Social Forestry Project (UP,HP,Raj,Guj)	World Bank/ USAID	1985-86 to 1992-93	3872.90	6981.80	1198742
10	Gujarat Community Forestry Project	World Bank	1980-81 to 1984-85	666.50	676.40	108355
11	Orissa Social Forestry Project, (Phase-I)	SIDA	1983-84 to 1987-88	281.70	270.60	33592
12	Social Forestry Project Tamil Nadu (Phase-I)	SIDA	1981-82 to 1988-89	656.80	569.60	140363
13	Social Forestry Project Orissa (Phase-II)	SIDA	1988-89 to 1995-96	783.40	1368.00	119450
14	Social Forestry Project Tamil Nadu (Phase-II)	SIDA	1988-89 to 1995-96	854.00	1548.60	108176
15	West Bengal Forestry Project	World Bank	1992-93 to 1997-98	1140.00	1367.90	205711
16	Rehabilitation of Common lands in Aravallis, Haryana	EEC	1990-91 to 1999-00	481.50	1164.96	58050
	Total			13381.90	19540.26	288504

Source : Ministry of Environment and Forests, Government of India, New Delhi.

SHORT-TERM, MEDIUM-TERM AND LONG-TERM TECHNOLOGICAL INTERVENTIONS FOR COMBATING DESERTIFICATION IN THE COUNTRY¹

Short-term measures the core object of the short-term measures is capacity building of farmers through the diffusion of low cost implementable technologies. Short-term measures, for example, are drought tolerant varieties, inter-bund treatments like keyline tillage, summer ploughing, ploughing/sowing across the slope, green loppings land cover cum manure treatment, vegetative barriers, ridge-furrow configurations for planting, opening of dead-furrows, etc. As may be seen these technologies address the problem on short-term basis with a view to provide immediate benefit to farmers. These are simple and easily implementable technologies which the farmers can adopt at their farm level (irrespective of farm size) of course, as far as possible on watershed basis with a little or no help from external agencies. These interventions would not need much monetary inputs yet may lead to tangible benefits from improved crop productivity, thus resulting in indigenous capacity building. This would build the confidence of the farmer in the programme and change their mind set to adopt medium and long-term measures in due course which will obviously need more of his contribution both in terms of labour and cash input. Such technologies act as stepping stones towards the longer-term task of arresting land degradation and help in capacity building and also play a catalytic role in obtaining peoples' participation. Higher level of farmer participation can be realised by integrating indigenous technologies/refinements into the programme. Conducting on-farm research in a participatory mode will further fine tune the technologies and help speedy adoption by the stakeholders. These short-term measures are particularly meant to ensure utilisation of the *in situ* conserved moisture integrated with improved crop management for enhancing the crop yield.

Medium-term measures once the farmers begin to realize the benefits of adopting technologies through short-term measures, they can better understand the goals for control of desertification and respond to participate in the adoption of medium and long-term measures. Integrated watershed management involving farmer participatory technology development (PTD) with a farming system perspective is central to medium-term measures. The on-farm research conducted as a component of short-term measures should provide feed back for necessary improvements. Regularization of drainage channels, diversion drains, ground water recharge, water harvesting on small scale, in medium size reservoirs and renovation of existing tanks, etc. and adoption of alternate land use systems are the examples of interventions as

¹ Recommendations of Working Group No. 2 on "Sustainable Land Use Practices"

medium term measures. The structures created need periodic modification/repair to retain their effectiveness for erosion control and moisture conservation from time to time. Construction of such structures needs major initiative from the farmer with support from the Government.

Long-term measures besides generation of large-scale surface and ground water resources, amelioration of wastelands, which have gone out of cultivation, should receive special attention in such interventions. Reclamation of shallow and medium deep ravines, salt affected lands, waterlogged areas, and stabilisation of sand dunes and sandy hummocky terrain's (low rainfall < 200 mm, AESR 2.1 and 2.3) should be the target areas for long-term plans. The emphasis here is to develop alternate land use systems with silvi-pasture integrated to livestock management as the key intervention. These should be emphasised as long-term measures, which restore the land back into production system. For instance an area of sandy hummocky land about 1 m ha (Pali-Digga AESR 2.1) in Jaisalmer district is lying unutilised. Normal rainfall in this region is 150 mm. Compact concretion occurs at 1-2 m depth in the profile. Consequently the area is devoid of tree vegetation. However, this is the natural habitat of *sewan* grass (*Lasiurs indicus*), the main stay of livestock farming in desert region. The existing grass stand gives ample evidence that this must have been a rich grazing land in the not-too distant past. The area, therefore, still offers considerable potential for introduction of animal husbandry. Reseeding and management of these open raingelands can be possible. Water harvesting through *tankas* with large constructed catchment can meet the drinking water requirement of livestock. However, a major initiative by the GOI/State of Rajasthan is required for rehabilitation besides the technological interventions. At present the area has a very low population density.

**CONSTITUTION OF THE NATIONAL STEERING COMMITTEE (NSC) TO COMBAT
DESERTIFICATION**

Government of India Ministries / Departments

- | | | |
|-----|--|-------------------|
| 1. | Special Secretary*,
Ministry of Environment and Forests | Chairperson |
| 2. | Joint Secretary,
Ministry of Environment and Forests | Member- Secretary |
| 3. | Additional Inspector General of Forests.
Forest Conservation Division,
Ministry of Environment and Forests | |
| 4 | Additional Director, Desertification Cell,
Ministry of Environment and Forests | |
| 5. | Secretary*,
Department of Agriculture and Co-operation (Rainfed farming, Watershed Projects, Disaster Management) ,
Ministry of Agriculture | |
| 6. | Secretary*,
Department of Animal Husbandry,
Ministry of Agriculture | |
| 7. | Secretary,
Department of Agricultural Research and Education (DARE),
Ministry of Agriculture & DG, Indian Council for Agricultural Research (ICAR) | |
| 8. | Secretary,
Department of Rural Development & Department of Land Resources, and Department of Drinking Water
Supply,
Ministry of Rural Development | |
| 9. | Secretary,
Ministry of Health | |
| 10. | Secretary,
Department of Woman and Child Development,
Ministry of Human Resource Development | |
| 11. | Secretary,
Department of Education
Ministry of Human Resource Development | |
| 12. | Secretary,
Ministry of Water Resources | |
| 13. | Secretary,
Ministry of Social Justice and Empowerment | |
| 14. | Secretary,
Ministry of Non-Conventional Energy Sources (MNES) | |

Research & Development and Survey Institutions

15. Director,
National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), Nagpur.
16. Director,
Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad.
17. Director,
Central Soil and Water Conservation Research & Training Institute (CSWCR &TI), Dehradun.
18. Director,
Arid Forest Research Institute (AFRI), Jodhpur.
19. Director,
National Research Centre for Agroforestry (NRCAF), Jhansi.
20. Director-General,
India Meteorological Department, New Delhi.
21. Director,
National Atlas and Thematic Mapping Organisation (NATMO), Calcutta.
22. Director,
National Institute of Rural Development (NIRD), Hyderabad
23. Director*,
National Remote Sensing Agency (NRSA), Hyderabad
24. Director *
All India Soil and Land Use Survey (AISLUS), Department of Agriculture and Co-operation, New Delhi

Other Organisations

25. Adviser(s)
(Environment & Forests, Rural Development and Agriculture)
Planning Commission, New Delhi.
26. Assistant Resident Representative, UNDP, New Delhi.
27. Representative NGOs including RIOD-India.

[* Revised Order of MOEF on new NSC to be released soon]

WORKING GROUPS AND THEIR TERMS OF REFERENCE for FORMULATION OF NATIONAL ACTION PROGRAMME**Working Group 1 (WG#1): Desertification Monitoring and Assessment and Early Warning Systems.**

Headed by: Head, Natural Resource Management (NRM) Division, Indian Council for Agricultural Research (ICAR), New Delhi.

Member Organisations

- Indian Meteorological Department (IMD).
- Indian Space Research Organisation (ISRO) and National Remote Sensing Agency (NRSA).
- Ministry of Water Resources.
- Ministry of Rural Development (Division dealing with DDP, DPAP Schemes).
- Ministry of Agriculture:
- Department of Agriculture & Cooperation (Divisions dealing with Rainfed Agriculture, Watershed Management, Natural Disaster Management).
- Department of Animal Husbandry.
- Department of Agricultural Research & Education.
- Ministry of Food.
- State Departments Of Agriculture, Forest, Health and Rural Development of the States of Madhya Pradesh, Rajasthan.
- National Atlas & Thematic Mapping Organisation (NATMO), Calcutta.
- National Bureau of Soil Survey & Landuse Planning (NBSS&LUP), Nagpur.
- All India Soil & Landuse Survey (AISLUS), New Delhi.
- Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad.
- Central Soil Salinity Research Institute (CSSRI), Karnal.
- Central Groundwater Board (CGWB).
- National Afforestation and Ecodevelopment Board (NAEB).
- Society for Promotion of Wastelands Development (SPWD) (NGO).
- National Centre for Medium Range Weather Forecasting (DST).
- Central Arid Zone Research Institute (Member- Secretary).

Terms of Reference:

1. Identify the most vulnerable dryland regions which are being degraded at an alarming rate or are susceptible to degradation and require immediate attention.
2. Enhance national climatological, meteorological and hydrological capabilities and the means to provide for drought early warning, and strengthen drought preparedness and management, including drought contingency plans at the local, national, sub-regional and regional levels.
3. Mitigation of drought: Establish/ strengthen food security systems, including storage and marketing facilities.
4. Dissemination of information to relevant stakeholders.

Working Group 2 (WG#2): Sustainable Land Use Practices for Combating Desertification

Headed by: Head, Natural Resource Management (NRM) Division, ICAR, New Delhi.

Member Organisations

- Ministry of Agriculture:
 - Department of Animal Husbandry.
 - Department of Agriculture & Cooperation (Plant Protection Directorate, Division for Division for Natural Disaster Management).

- Ministry of Environment & Forests (NAEB).
- Ministry of Water Resources.
- Ministry of Rural Development - Department Land Resources.
- Ministry of Non-Conventional Energy Sources.
- State Departments of Agriculture, Forest, Health and Rural Development of the States of Rajasthan and Gujarat..
- Central Ground Water Board (CGWB), New Delhi.
- Central Arid Zone Research Institute, Jodhpur.
- National Research Centre for Agroforestry (NRCAF), Jhansi.
- Central Soil & Water Conservation Research & Training Institute (CSWCR&TI), Dehra Dun.
- Indian Grassland & Fodder Research Institute (IGFRI), Jhansi.
- Arid Forest Research Institute (AFRI), Jodhpur.
- Agha Khan Rural Support Programme (AKRSP) Ahmedabad (NGO).
- PRADAN (NGO).
- Planning Commission, New Delhi.
- Dasholi Gram Swarajya Mandal, Chamoli (Member - RIOD, India).
- Central Research Institute for Dryland Agriculture (CRIDA) (Member-Secretary).

Terms of Reference

1. Strategies for combating desertification through sustainable land use agricultural practices. Strategies and programmes for arable land management, and soil conservation in the short-term (5 years.), medium (10 years) and long-term (25 years), giving particular attention to the implementation of preventive measures for land that are not degraded or are only slightly degraded.
2. Augmentation of fodder and fuel for the next 15-20 years.
3. Management of rangelands and pasturelands including livestock.
4. Research and Development - technology development and application in the above-mentioned areas, application of traditional knowledge to cope with different socio-economic, ecological and geo-physical conditions. Effective networking between R&D and its applications in the relevant sectors.
5. Application of alternate sources of energy.
6. Incorporate strategies for effective participation of local communities, particularly women.
7. Dissemination of information to all relevant stakeholders in the different dryland regions of the country through RIOD, ENVIS and SDNP.

Working Group 3 (WG#3): Local Area Development Programmes (LADPs)

Headed by: Joint Secretary, Ministry of Rural Development.

Member Organisations

- Ministry of Health (Department of Family Welfare).
- Ministry of Water Resources.
- Ministry of Social Justice.
- Ministry of Agriculture & Cooperation (Division dealing with watershed management).
- Ministry of Environment & Forests (NAEB).
- Department of Education.
- Department of Sports & Youth Affairs.
- Rajiv Gandhi Drinking Water Mission.
- Planning Commission.
- Council for Advancement for People's Action & Rural Technology, (CAPART), New Delhi.
- National Bank for Agricultural & Rural Development (NABARD).
- Tarun Bharat Sangh (NGO).
- Dasholi Gram Swarajya Mandal, Chamoli (Member - RIOD, India).

- Departments of Rural Development, Women & Child Development,, Forests and
- Agriculture in the States of Andhra Pradesh, Karnataka, Haryana & Gujarat
- Dept of Women & Child Development (Member-Secretary)

Terms of Reference

1. Local Area Development Programmes such as integrated micro-watershed development and management, programmes on community development including health, literacy and people's participation including women's participation and development.
2. Capacity building and strengthening the roles of various stakeholders. Identify programmes, schemes that can be taken up, for strengthening LADP in the dryland regions of the country.
3. Income generation schemes for poverty eradication.
4. Revival of traditional methods of water harvesting.
5. Dissemination of information through effective networking on all elements with all stakeholders.

Working Group 4 (WG#4): Policy and Institutional Framework

Headed by: Joint Secretary, Ministry of Environment & Forests.

Member organisations

- Ministry of Rural Development.
- Ministry of Agriculture & Cooperation (Departments of Agriculture & Cooperation, Agriculture Research and Education and Animal Husbandry).
- Ministry of Water Resources.
- Ministry of Social Justice.
- Ministry of Human Resource Development.
- Ministry of Women & Child Development.
- Ministry of Non-Conventional Energy Sources.
- Planning Commission, New Delhi.
- NABARD.
- UNDP.
- RIOD.
- National Institute for Rural Development (NIRD), Hyderabad.
- Central Arid Zone Research institute, Jodhpur.
- State Governments of Rajasthan, Gujarat, Maharashtra, Karnataka, Madhya Pradesh and Andhra Pradesh, Haryana (dealing with watershed development in drylands, poverty alleviation, land regeneration).
- NAEB (Member-Secretary).

Terms of Reference:

1. Compilation of existing plan programmes and schemes, under implementation at the center and the States on various areas relating to environmental conservation, local area development, agricultural production, community development, etc. Identifying their impact in improving the standard of the local communities.
2. Constraints faced in implementation of programmes, understanding the gaps in the institutional framework, policy structure and legislation.
3. Financial assistance - Multilateral and Bilateral cooperation.



INDIA
NATION ACTION PROGRAMME TO COMBAT DESERTIFICATION

In the Context of
UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION
(UNCCD)

Volume-II
National Action Programme

MINISTRY OF ENVIRONMENT & FORESTS
GOVERNMENT OF INDIA
NEW DELHI

September 2001

INDIA
Volume II -NATIONAL ACTION PROGRAMME

In the context of

UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

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Volume-II INDIA – NATIONAL ACTION PROGRAMME

In the context of

UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (UNCCD)

EXECUTIVE SUMMARY

The Approach visualised under the National Action Programme veers around the following aspects:

- 1) It takes into account the problem of desertification in the dryland regions of the country as a whole and would tend to coordinate the activities through integrated approach.
- 2) It reckons the problem of desertification as multi-sectoral requiring coordinated approach.
- 3) It recognises the need for mapping and intensive-extensive analysis for categorisation of area and to assess the level and degree of degradation. On the basis of the analysis, the prioritisation can be undertaken for both preventive and restorative initiatives/measures.
- 4) It recognises that water is a diacritical element for building people's confidence and satisfaction level, reclamation of degraded lands for sustainable biomass production ultimately leading to a better quality of life and enabling conditions through empowerment of the local communities. Therefore, water would be central to programmes for ecoregeneration and for improving the living conditions of the local communities.
- 5) Bottom up approach and project planning, evaluation and monitoring by *Panchayati Raj* Institutions (PRIs) (Grass root level elected local self Governments which provide for at least 30% representation for women). Capacity of the PRIs and CBOs constituted by them, like self-help groups and user groups, etc., would be built up on all aspects of land development including rehabilitation of degraded areas, encompassing technical, financial group dynamics, equity, gender, etc.
- 6) Convergence of resources and services. All resources available under different schemes will be channelled through *Panchayats*. Thus, a single window service will be available to the communities.
- 7) It emphasises the need to strengthen, consolidate and to undertake gap filling of the initiatives taken under the National Watershed Development Project for Rainfed Areas (NWDPRAs), the Drought Prone Areas Programme (DPAP), the Desert Development Programme (DDP) and the Integrated Wastelands Development Programme (IWDP). Gaps in all the on-going schemes of different departments which are relevant in the context of desertification would be identified and resources required for achieving the desired objectives at the ground level. A study for identification of gaps will be undertaken to form the basis of an Action Plan.
- 8) NAP would be harmonised with the projections and long term approaches, priorities and perspective plans of India for combating desertification.
- 9) NAP will seek to strengthen the existing network and institutional/organisational framework of each

Department rather than proliferation of institution and duplication of efforts. However, at the grassroots level, the PR institutions will be promoted for ensuing community participation and to have a decentralised mechanism of planning and implementation.

- 10) The first five-year period will be experimental and include pilot projects and activities.
- 11) Concurrent and continuous monitoring will be done and mid-course correction will be effected as the experiences are gained.
- 10) The problem faced by the farmers will be reported to R&D institutions for finding solutions. Thus both lab-to-land and land-to-lab flow of information will be ensured.

1. INTRODUCTION

1.1 ECOLOGICAL ENDOWMENTS AND BIOTIC PRESSURES

India has 2.4% of land, 16.7% human population and 18.0% of livestock of the world's population. It is endowed with rich biological diversity, both in flora and fauna including a variety of wildlife because of its diverse physiography and varied climatic conditions. India is one of the 12 mega biodiversity centres of the world. Out of the 18 unique biodiversity 'hotspots' which contain about 20% of the world's flora, two, namely – North-Eastern Himalayas and the Western Ghats are located in India. Indian forests are characterised by a wide variety including a spectrum of tropical, sub tropical, temperate and alpine forest. The landscape is composed of hills, plateaus, and valleys with undulating topography.

Rainfall is predominantly *monsoonal*– limited to 3-4 months of rain followed by 6-9 months of dry winter and hot dry summer. Precipitation is characterised by high intensity storms on a few rainy days, interspersed with dry spells. Sometimes *monsoon* starts late and sometimes it withdraws early. There is extreme spatial variation ranging from 150 mm in western India to about 4000 mm in North Eastern region. There is high rainfall variation between the years and between the decades. This geo-hydro regime of the country – undulating topography and high intensity storms - trigger high velocity run off making large parts of the country vulnerable to soil erosion. Low rainfall areas in the vicinity of the Thar Desert and sandy coastal areas suffer from wind erosion. Inland areas and some foothills with drainage congestion suffer from salinisation and water logging.

The hot summer temperature in arid and semi-arid areas goes upto 45-48°C. Dry winter, and hot summer cause high potential evapo-transpiration. Thus the geo-hydro-thermo folio of India makes large parts of the country vulnerable to water and wind erosion, salinisation and water logging, drought and desertification etc.

The vulnerability of the land to different forms of degradation is accentuated by high biotic pressure - human and livestock population - resulting in unsustainable landuse - 'over cultivation, over-grazing, deforestation and poor irrigation practices' (UNCCD Fact Sheet 2). Consequently, large portions of landscape are susceptible to and suffering from one or other forms of land degradation.

However, the relationship between population and land is not simplistic. It is relevant to quote from UNCCD Fact Sheet 2, "**What role do increasing population and population densities play?** It is tempting to conclude that an expanding human population is the ultimate driving force behind desertification. More people in an area inevitably exert a greater pressure on that area's resources; sometimes this pressure is indirect, as when growing urban population place demands on food production from rural areas. But the causes of desertification are complex, and the relationship between two variables such as population and desertification is not clear-cut. For example, a decline in population can result in desertification since there may no longer be enough people to manage the land adequately."

Indian experience indicates that sustainable land use does not hinge only on "carrying capacity of the land". It also depends on "caring capacity" of the land users/managers. Many high lands in Himalayan regions are being used in a sustainable manner for a long time where terraces are being supported by risers which are duly reinforced by local vegetation. Similarly in dry western part of Rajasthan, an indigenous rain water

management system “KHADIN” promotes crop cultivation in post rainy season in winter months in the areas where rainfall – PET relationship would not have sustained such production systems.

Further the critical role of livestock in dry areas has not been fully perceived or comprehended by many experts. But the farmers know that there is no or little microbial activities in the soil as moisture level falls below critical levels in winter and summer season. In this situation it is the natural agency of livestock that collects dry biomass, digest it and delivers in the decompost form. The addition of compost in cultivated fields in the beginning of monsoon not only provides nutrients and improves physical conditions of the soil but also inoculates the soil with microbes. Nevertheless for maintaining vigour, health and purity of land (soils) and for producing food, fodder and fuel in sustainable manner, the ecological potential and limitations should be respected. The involute and delicate relationship between land and man and livestock is dynamic and complex and cannot be explained away in straight jacket simplistic matrix.

1.2 DROUGHTS AND FAMINES IN RETROSPECT – PAST EFFORTS AND LESSONS LEARNT

Endowed with *monsoonal* rainfall with erratic and uncertain amount, intensity and distribution within the rainy season and between the years, India had to face droughts and famines in its long history. The infamous famine of 1914 and the resultant hardship faced by millions of people in arid and semi-arid areas led to the fielding of Royal Commission on Agriculture. In pursuance of its recommendation, five dry land farming centres were established in different dry regions of the country in 1920s. After independence many research stations have been set up for research on various aspects of land degradation. A number of development projects have also been initiated and models tried out where successes and failures have been studied, analysed and chronicled. Some of the important lessons learnt from the experiences particularly on land degradation are relevant to UNCCD and are briefly described below:

1.2.1 CENTRALISED APPROACH VIS-A-VIS PEOPLE'S PARTICIPATION

India has been constantly making fervid and assiduous endeavour to develop both short-term and long-term strategy for tackling the problems of degraded lands both within and outside the forest area. But it was realised that a centralised approach of development suffered from inherent deficiencies in deciding the choice of schemes and to ensure sustainability of programme activities without the involvement of the community. As a result, the progress has been slow. For example, the Drought Prone Area Development Programme (DPAP) has a problem area of 74.6 mha situated in 947 drought prone blocks in the country. But only about 7.5 mha is likely to be treated by 2002. This is only 10% of the problem area. It was therefore realised that unless the programme of rehabilitation of the degraded lands becomes the need and initiative of the local people, desired results could not be achieved.

At macro level, perceptible results could not be achieved in drought proofing of the vulnerable areas, preventing the siltation of reservoirs and stabilisation of production on vast rainfed lands. The diagnostic analysis revealed that the progress of rehabilitation could be accelerated with active participation of the people, once they realise the importance and utility of the scheme.

In light of the above, the National Watershed Project for Rainfed Areas (NWDPR) made a departure in policy in 1990 that watershed development project should become people's initiative and Government should participate in it. It was also noted that the concept of ownership is critical for success and sustainability of

the project activities. Around the same time, the Ministry of Environment and Forests introduced the concept of Joint Forest Management wherein communities are playing a prominent role in protection of the forest and are sharing in the usufruct in a predetermined ratio with the Government.

These Indian experiences and initiatives are in tune with the CCD approach and strategy.

1.2.2 LONG TERM STRATEGY AND PRIORITIES – NEED FOR VISION DOCUMENTS AND PERSPECTIVE PLANS

Realising the widespread hardship to millions of people in arid and semi-arid areas due to droughts and land degradation, the Parliamentary Committee on Agriculture and Rural Development reviewed the on-going schemes of drought proofing in rainfed areas in the country. The Committee directed that a long term strategy and perspective plans should be prepared and implemented for reversal of land degradation and conservation of water resources in a given time frame – 25 years (1997-2022).

In compliance, the Planning Commission in consultation with relevant Central Ministries, State Governments and NGOs prepared a Twenty-Five Years Perspective Plan for the development of the rainfed areas. The perspective plan proposes development of 63.4 mha of degraded land at the cost of Rs.758,000 million. But India as a developing country finds it difficult to provide funds on such a scale. For IX Five Year Plan the Committee had recommended Rs. 5,000 million but only a sum of about Rs.3,000 million could be provided due to financial constraints.

The Ministry of Environment and Forests in August 1999 prepared a National Forestry Action Programme (NFAP) for afforestation of one-third of the country's geographical area, in the next twenty years subject to availability of funds.

Thus India has been endeavouring to develop long term strategy, priority and plans for rehabilitation of degraded lands which is in tune with the CCD objectives.

1.2.3 RAIN WATER MANAGEMENT HOLDS THE KEY FOR REHABILITATION OF DEGRADED LANDS - WATER- A DIACRITICAL ELEMENT FOR SUSTAINABLE DEVELOPMENT

Indian experience of about 50 years of land reclamation and development brought out the realisation that the availability of water inspires local communities and builds their confidence for initiating the process of reversal of land degradation and move towards sustainable landuse. Successful projects like Sukhomarjri in Haryana, Ralegaon Sidhi in Maharashtra, etc., on propagation of water conservation/harvesting technology have earned attention and respect from policy makers, planners, field workers and farmers. Similarly in a number of success stories, conservation, collection, storage, recharge and utilisation of water has been the central activity.

Water erosion, rill and gully erosion are the symptoms of the problem and not the cause of it. The cause is the volume and velocity of surface flow (run off). If the volume and velocity of the surface flow is minimised by *in-situ* moisture conservation, water harvesting and consequent recharge of ground water by converting surface flow into sub surface flow, water erosion can be minimised to a great extent. Similarly by *in-situ* moisture conservation and increasing water availability of the soil profile, the growth of ground flora, middle flora and top flora would be enhanced and the impact of wind erosion could be minimised.

Thus, scientific management of rainwater would minimise water and wind erosion and support growth of crops, grasses, shrubs and trees for the benefit of the local community. It was against this backdrop of national policies, priorities and lessons learnt that India participates in the UNCCD with the hope that its national resources would be supplemented and country would gain from sub-regional, regional and international participation. India will also share its technologies and lessons learnt with other affected countries.

1.2.4 ENABLING ENVIRONMENT CREATED BY THE GOVERNMENT

National and State Governments are providing enabling constitutional, legal, financial and policy support to local communities for management of their natural resources. There are a number of legislations, policy documents, resolutions which create enabling environment for people to take initiative for preventing and reversing land degradation both in core areas of natural resource management and associated spheres of human development. The 73rd Constitutional Amendment – *Panchayati Raj* Act of 1992 enabled devolution of power for management of land resources to grass root level *panchayats* (elected democratic institutions). Now PRIs have been vested with powers in respects of soil conservation, watershed development and minor irrigation.

Thus it would be seen that India has been implementing measures relating to constitution, policy, planning, and programmes for combating land degradation in the country which are in tune with UNCCD objectives.

2. ASSESSMENT OF DRY LAND DEGRADATION AND PRIORITISATION FOR COMBATING DESERTIFICATION

2.1 ESTIMATES OF DEGRADED LAND

India has a total geographical area of about 328 mha, out of which about 64 mha are covered under habitation (rural and urban), industries and industrial infrastructure, roads, railways, rivers, canals rocky outcrop, snow covered peaks and desert areas which are not available for biomass production. Of the remaining area of 264 mha the landuse is indicated below:

Agriculture/Cultivated area	-	142 mha
Forest	-	67 mha
Permanent Fallows	-	24 mha
Pastures	-	12 mha
Culturable Wasteland	-	16 mha
Trees and Groves	-	3 mha
Total		264 mha

Out of the above land use categories 90 mha of agricultural land, 31 mha of forest land, 24 mha of permanent fallows, 12mha of pastures and 16 mha of culturable wasteland are suffering from different forms of land degradation (about 173 mha). Of this about 130.6 mha are within the dryland region of arid, semi-arid and dry sub-humid region (using Thornthwaite System). So far about 30 mha of degraded lands of the total 173 mha in the entire country have been treated. It is proposed that about 90 mha be addressed under the Long-term Strategy Phase I of the National Action Programme for Combating Desertification in the country. This is explained in detail in the following sections.

The existing district-wise information on using some selected indicators - bio-physical and social- impacting desertification is given in Annex 1. The States and the districts listed may be treated as provisional to facilitate the commencement of the first phase of the Action Plan. A detailed exercise would be done in the first phase of the Action Programme involving other relevant organisations such as the India Meteorological Department (IMD), Central Research Institute for Dryland Agriculture (CRIDA), All India Soil and Land Use Survey (AISLUS) and the National Bureau of Soil Survey and Land Use Planning (NBSSLUP). Based on such a study, the details of the districts falling within the dryland regions of the country and the extent of degradation would be worked out. Further, the districts would require to be prioritised for taking corrective action, on the basis of the status of land degradation and status of human development, using a set of benchmarks and indicators involving biophysical, socio-economic and human development parameters. The National Mission on Soil Survey and Mapping of Land Degradation would also bring out accurate estimates of the area and extent of land degradation including the drylands in the country, involving the concerned institutions such as the IMD, ICAR, NBSSLUP, CRIDA, etc.

2.2 CRITERIA/INDICATORS FOR IDENTIFICATION AND PRIORITISATION OF DEGRADED DRYLANDS FOR COMBATING DESERTIFICATION

In identifying the priority areas for rehabilitation through intensive conservation measures and production systems, district-wise status of land degradation and status of human development has been collected, and presented using a set of benchmarks and indicators. These indices include biophysical, socio-economic and human development parameters. A brief account of indicators to be used for assessment of degradation are enumerated below:

A. BIO-PHYSICAL INDICATORS

(1) Climatic and Weather Criteria

- (i) Rainfall –PET Ratio – within the range from 0.05 to 0.65 (selected stations)
- (ii) Rainfall range.
- (iii) Departure from normal (in %)
- (iv) Frequency of Droughts – (Long-term) -for a 30 year period.

(2) Soil Condition - Deterioration of Physical, Chemical, Biological Properties of Soil

- (i) Type of Land Degradation
- (ii) Extent of Land Degradation (in sq.km)

(3) Long term Impacts

- (i) Loss of Vegetative (Forest) cover and Trend.
- (ii) Livestock (bovine) pressures (livestock density) - Total and No./sq.km
- (iii) Decline in groundwater table (Long-term -20 years)

(4) Low Productivity

- (i) Agricultural yield of three principal crops as compared to National Average Yields and trend in agricultural yield.

B. SOCIO-ECONOMIC AND HUMAN DEVELOPMENT INDICATORS

1. (i) Per capita Income
- (ii) Percentage of population below poverty line.
- (iii) Total Population
- (iv) Population density (No./sq.km)
- (v) Adult Literacy (male and Female)

- (vi) Sex Ratio
- (vii) Total Fertility Rate (No./1000 females)
- (viii) Infant Mortality Rate (per 1000 births)
- (ix) Percentage of households having electricity, water supply and sanitation facilities.
- (x) Percentage of households having none of the above three facilities.

The above criteria and indicators would be used to identify priority areas under UNCCD during pilot phase of five years (2002-2007). During the course of the progress the criteria and indicators would be reviewed/ refined, if necessary.

2.2.1 Selection of areas in the dryland regions on the basis of severity of degradation and status of human development would be made as given below:

- Severely Degraded
- Moderately Degraded
- Slightly Degraded
- Not degraded so far but susceptible to degradation.

AREAS WITH MODERATE TO SEVERE DEGRADATION

Land degradation and poverty go hand in hand. Areas of severe land degradation are also the areas where the majority of poor population is somehow eking out a subsistence living under harsh ecological environment and socio-economic settings.

AREAS WITH SLIGHT DEGRADATION

Preventive measures with little external support would be taken. Farmers/land users would be made aware of the problems and advised to take up preventive cultural measures – sustainable agricultural practices as short term measures – like cultivation across the slope, moisture conservation tillage, addition of bulky organic manure and soil amendments, planting shelter belts and wind breaks. Such areas are indicated in Annex I. However, precise delineation would be done under first phase of five years (2002-2007).

2.3. REGIONS AND AREAS FOR PRIORITY ACTION

While final identification of districts/Blocks would be done during 1st/2nd year of the short term phase, on the basis of available information following areas would qualify for priority identification.

- 2.3.1 Arid and Semi Arid North Western India – South Haryana, North West Rajasthan and Northern Gujarat
- 2.3.2. Semi-arid Central Deccan Plateau – Northern Dry Zone of Karnataka and adjoining areas of Andhra Pradesh and Maharashtra.
- 2.3.3 Semi-arid Central –Eastern Region – Rocky, Undulating, Tribal Plateau - South Western Orissa, Eastern Chattisgarh and Southern Jharkhand.
- 2.3.4 Sub humid Areas showing salinisation, sodification and waterlogging – Parts of Haryana, Punjab and Uttar Pradesh.
- 2.5. Degraded Forest Lands – in arid, semi arid and dry sub humid regions

3. PHASING OVER OF DEGRADED LAND FOR REHABILITATION

The degraded lands would be treated in a phased manner as indicated below.

3.1. SHORT TERM STRATEGY – FIVE YEARS – 2002-2007

3.2 LONG TERM STRATEGY

Phase I – 15 years – 2007-2022.

Phase II – 15 years – 2022-2037.

The phasing over and time line would be synchronised with national perspective plan and Five-Year Plans, long-term priorities and strategies.

While the first phase of the short-term strategy would cover a Five-Year period, the first phase of the long-term strategy - 2007-2022 - would cover an area of about 90 mha, out of which at least 5 mha will be rehabilitation of degraded forest lands. The estimated cost norms have taken into account the cost escalation and any other related factor. However, these are normative costs and the actual costs will vary as per actual requirement of the site and will be decided in consultation with *the Panchyati Raj* Institutions. Some difficult areas may justify an increase in costs.

4. APPROACH AND STRATEGY TO COMBAT DESERTIFICATION UNDER UNCCD

India as a developing country Party and signatory to the UNCCD would continue to adopt the approaches and strategies to combat desertification in tune with the provision of the UNCCD Convention. Incidentally it may be submitted that most of the approaches and strategies suggested in the UNCCD documents are of great importance to India as the country's strategies are in consonance with them. India would refine and improve its approaches through participation in sub regional, regional and international deliberations. Following approaches and strategies would be adopted:

4.1 INTEGRATION OF UNCCD WITH LONG TERM NATIONAL STRATEGIES AND PRIORITY

NAP under CCD would be integrated with long term strategies and priorities of the country for sustainable natural resource management. India has developed a Twenty-Five Years' Perspective Plan for Development of Rainfed Areas (1997-2022). Again the Working Group for Formulation of Xth Five-Year Plan (2002-2007) recommended Twenty Years' projections (2002-2022) for watershed development, rainfed farming and natural resource management. NAP would be harmonised with these projections and long term approaches, priority and programme of India.

4.2 SALIENT FEATURES OF APPROACH AND STRATEGY

In 1990s, it was increasingly recognised that people's participation was central to the sound efficacious and tenacious planning process. This period marked a definite departure from centralised planning to a decentralised system with strong inputs for securing people's involvement. Many initiatives were taken to associate people with the planning and implementation of the schemes. This realisation primarily grew from (a) the fact that there was a tremendous hiatus in the conceptualisation of a programme and its implementation, (b) that people's concerns and requirements had to be integrated with the planning process to account for a pragmatic and innovative Strategy, and (c) that the sustainability of the schemes/projects could be ensured only through people's involvement.

There ensued the process of restructuring the schemes to manifest the revised trends. To illustrate the point, in the Rural Development sector the schemes of DPAP/DDP did not yield the desired impact as is evident from the achievements over years. As against 74.6 mha only 7.5 mha would be treated upto 2002. In recent years, the Ministry of Rural Development has made people's participation an integral part of their project design. Similarly, in NWDPR, people's involvement was visualised as an essential ingredient. In Forestry sector in 1990, the JFM concept was introduced to ensure partnership between the people and the Forest Department for protection and development of forest area.

SALIENT FEATURES:

- (a) NAP proceeds on the premise that 'Water' is central to an effective strategy for combating desertification. Both from the standpoint of sustainability and imperative of integrating people's needs in the thematic aspect, 'water' seemingly is the most evocative, poignant and contextually relevant concern.
- (b) By ensuring availability of water, the whole system of production - productivity and living process would develop and veer around this concept.
- (c) Water will be viewed in the broader conspectus involving surface, sub-surface, regeneration and secondary sources like vegetation. In terms of treatment, it will encompass conservation, regeneration, development and harvesting of rainfall.
- (d) The focus will be to blend traditional technologies with the new initiatives.
- (e) This diacritical approach will set apart the programmes under UNCCD from other initiatives so far taken.
- (f) The major investment through the UNCCD approach will be to enhance the availability of water through cost-effective administratively efficient and model mix of traditional and new innovative strategies.
- (g) There would be earmarking of funds for water sources generation.
- (h) NAP will seek to strengthen the existing network and institutional/organisational framework of each Department rather than proliferation of institution and duplication of effort. Rather through UNCCD approach the gap in each organisation will be met and the efforts will be supplemented through a convergent approach.

4.3 INTEGRATED AND HOLISTIC APPROACH AND ACTIVITIES- BUILDING UPON INDIGENOUS TECHNICAL KNOW-HOW.

On the basis of about 50 years' experience of development, holistic approaches including land, water vegetation and animal resources would be promoted with following salient features:

- In arid, semi-arid and sub-humid regions rain water management – conservation and efficient use – would start the process of regeneration and reversal of land degradation. The centrality of rain water harvesting and in-situ moisture conservation for recharge of ground water would be the core activity.
- Conservation measures and PRODUCTION systems would be conceived, planned and implemented in the relationship of 'means' and 'ends' – conservation measures as 'means' and PRODUCTION systems as 'ends'. Farmers are more interested in production in a sustainable manner. Short-term benefits would be ensured to win the trust and confidence of the local community.
- Efforts should be made to build-upon indigenous system of water harvesting, cropping systems, agricultural practices and reinforce them with modern science and technology. This would be a blend of indigenous wisdom and innovations.

- LEISA (Low External Input Sustainable Agriculture) would be promoted. Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) would be popularised.
- Diversified land use systems including agroforestry, dry land horticulture would be promoted to reduce risk and increase the capacity of the farmers to face droughts.
- Mixed farming (crop + livestock) would be promoted as livestock play important role in land use systems of arid and semi-arid areas. Wherever possible organic farming would be promoted so that the farmers would earn premium on their produce.
- Regenerative forestry with limited new planting would be adopted to rehabilitate degraded forest areas.
- Land husbandry in place of conventional soil conservation measure would be promoted.
- Alternative livelihood of poor village households – marginal farmers and landless labourers - would be promoted to reduce pressure on the land to the extent possible.
- Silvipastures would be promoted on grazing lands as most of the rural poor depend on fodder from such CPRs.

The approaches are normative and indicative. Actual and specific approaches would be decided by the local communities as per their needs during the planning process.

4.4 INVOLVEMENT OF NGOS

NGOs would play an important role to enable village communities and their organisations and Panchayats. NGOs have already been recognised as Project Implementing Agencies (PIAs). A number of external NGOs are also working in India.

4.5 PREVENTIVE MEASURES

Preventive measures would be popularised through all possible means including field extension workers and NGOs staff to create awareness among land owners/users to adopt preventive measures against possible degradation; for example stabilisation of table lands to prevent ingress of the ravines in the vicinity of net work of the gullies.

4.6 GENDER AND SOCIAL EQUITY

Gender and social equity would be the main pursuit under the UNCCD. Special tools and techniques are being developed (investment equity analysis, women specific activities and tools). Capacity at field level would be improved through sub-regional and international level participation and learning.

The above approach and strategy are illustrated in the Figure 1.

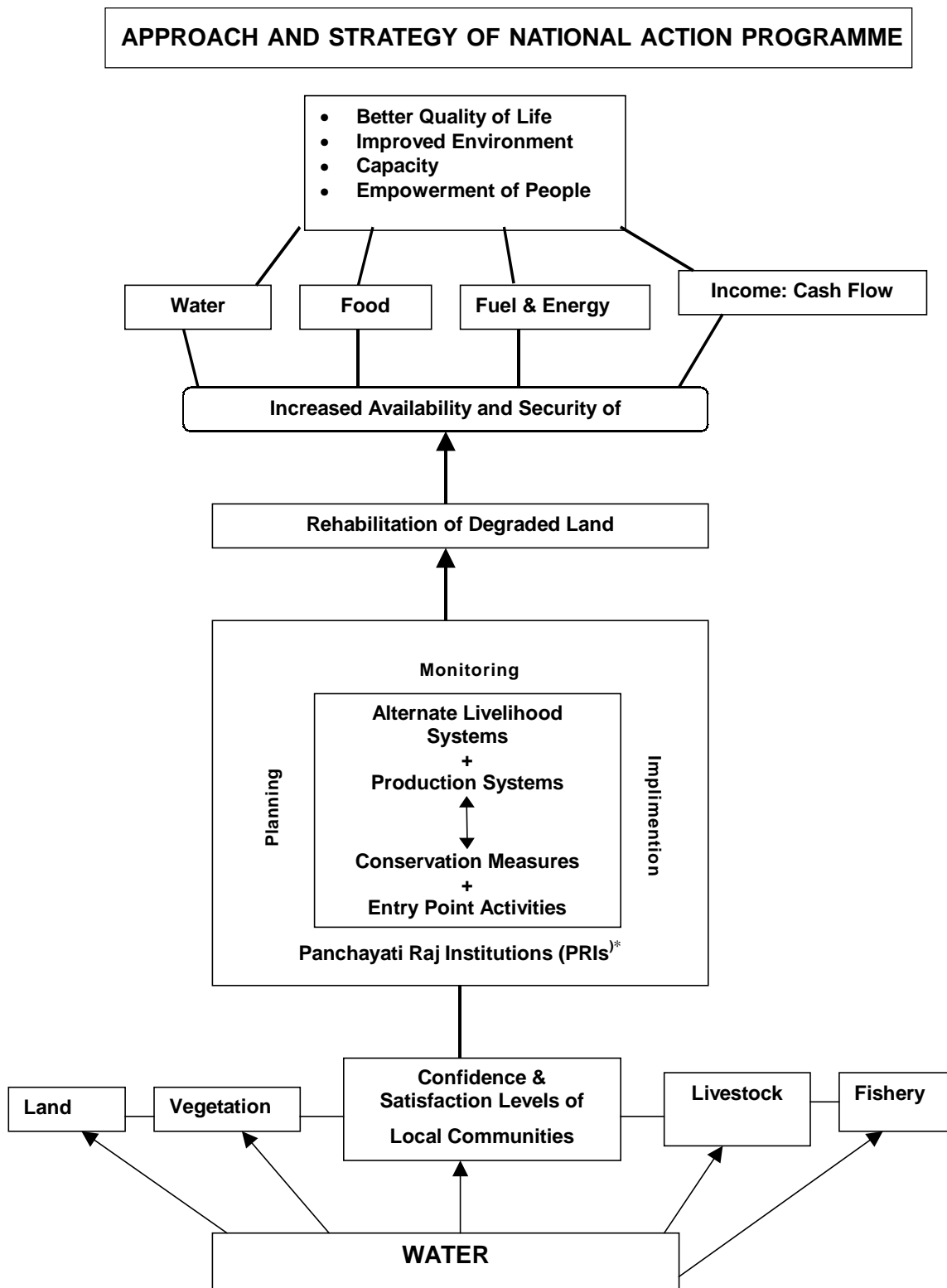


Fig.1 Organogram showing the Approach and Strategy of the NAP

* Grass-root level elected local self governments in which women have at least 30% representation

5. PROGRAMME COMPONENTS - ACTIVITIES AND INTERVENTIONS

The NAP would be planned and implemented in a phased manner building upon the experiences gained and the lessons learnt. There would be 3 phases –

Short Term	Preparatory and Pilot Phase		5 years
Long Term Phase	1	Up-scaling and implementing phase 1	15 years
Long Term Phase	2	Implementation and Withdrawal phase 2	15 years

This phasing harmonises with 25 years Perspective Plans and national vision for reclamation of degraded land as suggested in the UNCCD documents.

5.1 THE PROGRAMME WOULD INVOLVE THE FOLLOWING ELEMENTS/ACTIVITIES:

5.1.1 ENHANCEMENT OF METEOROLOGICAL, CLIMATOLOGICAL AND HYDROLOGICAL CAPABILITIES FOR EARLY WARNING SYSTEM.

The present crop weather watch group meets regularly in the Ministry of Agriculture at central level and officers of State Agriculture Department and Meteorological experts meet in the Directorates of Agriculture of State Governments to prepare crop weather bulletins to be broadcast by the All India Radio. The capability of Indian Meteorological Department and its centre would be improved through better electronic system for data collection analysis and information dissemination.

5.1.2 DROUGHT PREPAREDNESS AND MANAGEMENT INCLUDING DROUGHT CONTINGENCY PLANS

At present drought management is the responsibility of Natural Disaster Management Division in the Ministry of Agriculture. It would be broad based and its capacity would be enhanced through UNCCD.

5.1.3 REGULAR MONITORING AND REPORTING

Regular monitoring and reporting at national level would be the responsibility of UNCCD Secretariat, in the Ministry of Environment and Forest. Appropriate implementation and impacts indicators would be developed in participatory manner with local communities. Indicators would be simple, cost effective and reliable. Village unemployed youth/school dropouts would be trained to collect data like measuring of water-level in the well, to keep records which would be analysed. Initially small honorarium would be paid by the project but in due course farmers would pay for data collection and record keeping if they are really benefited by the project. This system is working very well in some of the watershed projects. However, the monitoring mechanism would be improved through UNCCD participation.

5.1.4 PUBLIC AWARENESS

Awareness of general public, politicians, policy makers, administrators, technocrats and field functionaries on dangers of land degradation and need/advantages of the efforts and actions to reverse degradation through print and electronic media, discussions, workshops, special **YATRAS** and events like **'Run For the Land'** would be enhanced.

5.1.5 PROMOTION OF ON FARM PARTICIPATORY RESEARCH FOR PARTICIPATORY TECHNOLOGY DEVELOPMENT.

Technology development is a continuous process. Participatory and on Farm Research would be taken up where local farmers/land users would actually participate in problem analysis, selection of probable solutions, laying out of field experiments/trials, data collections and analysis. Simple techniques would be applied so that farmers can understand and may suggest problem they are facing in presenting/reversing land degradation.

5.2. PHASED IMPLEMENTATION OF THE PROGRAMME

5.2.1 Short Term Preparatory Phase - PILOT OPERATIONS (2002-2007)

During this period all types of land degradation will be taken up in the areas where the problem of water erosion, wind erosion, salinisation, sodification and waterlogging are assuming alarming proportions. In each region a total of 5000 ha. of area covering 5-10 watershed in each commissioners' division will be taken up. Selection of districts would be made with the indicators used for identification of degraded districts in the country.

This phase would be pilot and preparatory in nature with sharp focus on enabling local communities and the village Institutions to effectively participate in problem analysis, planning, implementation, monitoring etc. of projects. Pilot watershed projects/land reclamation Projects will be taken up on practical considerations in consultation with the people so that appropriate refinement may be brought out on technical, social and institutional (at national, state and particularly at village levels) aspects. For each of the 4 priority areas – an overview of problem analysis, treatments, interventions and fund requirements are indicated below:

5.2.1.1 NORTH-WEST ARID REGION – LOW ANNUAL RAINFALL- 150 TO 400 MM.

(1) Area -This priority region would include southern part of Haryana, Western Rajasthan and Northern Gujarat (Proposed districts with ecological, economic, social and human development indicators are given in Annex 1. Statistical profile would be built up during the first phase of short strategy.

(2) Situational Analysis and Major Problems

There are intra-regional variations but major problems are wind and water erosion. In some pockets, recently brought under irrigation, problems of salinisation and water logging are also causing concern. Frequent droughts occur in this region – three times in last five years. Serious problems include decreasing water availability and receding water table, brackish ground water, depleting forest cover, deteriorating grazing grounds and pastures decreasing availability of fodder and drinking water, declining land productivity and yield of important crops, livestock suffering from scarcity of drinking water. In western parts of Rajasthan shifting sandunes is major problem. The major goal would be to enhance water, food and fodder security in this livestock based farming systems areas.

(3) Interventions - Entry Point Activities - Conservation Measures and Production Systems

(i) Entry point activities and capacity building of PRIs.

In most villages farmers demand water source for human and livestock drinking. Social capital building would be promoted. In addition, shed for schools, village link roads and culverts, community health centres, etc., will be provided/strengthened. Entry point activities will be decided in consultation with local communities.

The capacity of the PRIs will be developed to handle technical and financial matters including group dynamics.

(ii) Conservation Measures

- Water conservation measures based on indigenous systems like *NADI* (ponds), tankas (covered dugwell), *Khadins* and nala ponding in small rivers with tunnel recharge wells will be promoted. Farmers confidence increases with increasing availability of water
- Appropriate low cost soil conservation measures based on local systems of trench and furrows, vegetative hedges of local grasses and shrubs.
- *Kanabandi*, a unique indigenous system of fixing brush wood barriers across the prevailing direction of wind to stabilise the sandunes and save the crop from sand blows.
- Shelter belt, wind breaks and strip plantations.

(iii) Production System – Crop + Livestock Rearing

- Mixed farming to minimise risk of erratic rainfall and diversified production system, mixed cropping producing millets, pulses and oilseeds.
- Agroforestry and dry land horticulture.
- Strip and block plantation on desert front areas.
- Grazing grounds, silvipasture systems.

(iv) Alternative livelihood systems of rural poor – land based and non-land based activities like manufacturing of ethnic dresses, weaving of carpet etc. Livelihood would typically encompass water, food, fodder and feed security with income generation (cash flows).

(4) Cost Structure

Cost structure would vary from one to other situation in view of intra-region ecological diversity. However a normative cost structure is suggested below:

- (i) Creation of awareness and capacity building of PRIs including entry point activities.
@ Rs.1000/- per hectare.
- (ii) Conservation measures @Rs.5000/- per hectare (70% for water resources development and 30% for soil conservation).
- (iii) Production system @Rs.3000/- per hectare.
- (iv) Alternative livelihood systems @Rs.2000/- per hectare.

The average cost for 5000 hectare area in 5-15 watershed (located in a few districts) would be Rs.55 million @ Rs.11,000/- per hectare.

5.2.1.2 CENTRAL DECCAN PLATEAU – SEMI ARID REGION

(1) Area -This priority region includes low to medium rainfall Northern Karnataka and adjoining parts of Andhra Pradesh and Maharashtra.

(2) Situational Analysis and Major Problems

This region is characterised by undulating topography, low to medium rainfall, high intensity rain storms, high volume and speed of surface flow, severe water erosion and every low level of rainfall utilisation. Occurrence of intense drought and crop losses are quite frequent. Farmers are living in poverty. There have been reports of helpless farmers committing suicides due to crop failures. Low and fluctuating crop yields, over cultivation and shrinking pasture lands due to biotic pressures, receding ground water level and depleting vegetative cover are assuming alarming proportion.

(3) Interventions – EPA, Conservation measures and Production Systems

(i) Capacity building of PRIs and entry point activities

PRIs and their community based organisation will play a central role at field level. Their capacity will be built in technical, financial and institutional matters. NGO and Govt. field functionaries would create awareness about the dangers of land degradation, help in organising SHGs and other village institutions. The potential entry point activities may be creation of life saving irrigation during long dry spell in the cropping season.

(ii) Conservation Measures

Water Conservation – Life saving irrigation is the greatest need of the area. Collection of surplus surface flow in a network of small percolation ponds to recharge dugwells, continuous contour trenches for enhancing the recharge would also be taken up. The utilisation of harvested water during rainy season cropping and during the period of early withdrawal of monsoon and if possible, provision of pre-sowing irrigation for the next crops would be given priority. Thus water conservation would start the process of regeneration of eco-system.

(iii) Soil Conservation

Simple soil conservation measures in tune with traditional systems like small mud cum pebble bunds, boulder bunds, vegetative hedges and dead furrows in inter banded areas would be promoted.

(iv) Production System

- Mixed farming with reliance on organic farming.
 - LEISA (Low External Input Sustainable Agriculture) including Integrated Pest Management (IPM) and Integrated Nutrient Management.
 - Agroforestry and dry land horticulture.
- (v) Alternative livelihood system of poor households- such as ethnic dresses.

(4) Cost Structure

- Capacity building and entry point activities @Rs.1000/- per hectare.
- Conservation measures @Rs.5000/- per ha (70% for water resources development and 30% for soil conservation).
- Production system @Rs.3000/- per ha.
- Alternate livelihood system of rural poor @ Rs.2000/- per ha.

Total Rs.11000/- per hectare.

The cost of 5000 ha of area would be Rs.55 million.

5.2.1.3 HIGH SLOPE, HIGH RAINFALL, ROCKY TRIBAL PLATEAU REGION

(1) Area : High poverty, low income, water scarcity affected tribal areas of south west Orissa, South and Eastern parts of Chattisgarh and Southern Tribal Region of Jharkhand states.

(2) Situational Analysis and Major Problems

High rainfall with high intensity storms on sloppy land of rocky terrain generates high speed surface flow which causes severe soil erosion. Over cultivation and over grazing are depleting forest cover and land degradation is taking place at alarming rate due to loss of top soil. The landscape is criss-crossed by *nalas* and rivulets of ephemeral nature; such drainage lines swell up and overflow during rains but become dry soon after. After rainy season drainage lines are totally dry.

Scarcity of drinking water, unavailability of life saving irrigation, shallow soils with little water holding capacity,

create famine like situation in every drought. Frequency of droughts are increasing. Low and uncertain crop yields, malnutrition, livestock of poor health and low productivity, endemic diseases etc. have created a vicious cycle eroding ecological resource base, and causing acute water scarcity and sub human living conditions (Press inputs have indicated in recent years that poor tribals have even sold their children for water and food during scarcity period).

(3) Interventions –EPA, Conservation Measures and Production Systems

(i) Capacity Building of PRIs and CBOs and Entry Point Activities.

The literacy rate is low and capacity building would have to be accomplished with patience. But tribals have tradition of community based behaviour. A well structured awareness programme would be needed to organise them into Self-Help Groups in village institutions. The local population has good Indigenous Technical Know-how (ITKs). The project will build upon these systems and practices. The capacity of PRIs/CBOs would have to be nurtured and built in organisational, financial, record and book keeping etc. slowly in tune with their absorption capacity.

(ii) Conservation Measures

Rainwater harvesting in village ponds, desilting of existing ones and construction of new ponds at hydrologically strategic points to enhance water availability for human beings and livestock would be given highest priority. For life saving irrigation the upgradation of traditional low cost '**CHUAS**' (seepage wells) would be promoted and upgraded. Such wells would save the crops during drought, may provide pre-sowing irrigation for second crop and allow vegetable cultivation. Thus availability of water would build the confidence of local population and inspire them to move towards sustainable developments.

(iii) Soil Conservation Measures such as -Continuous contour trenches, vegetative hedges across the slope, loose boulders, gully checks reinforced with vegetation and loose bolder checks in drainage lines to control soil erosion and loss of top soil.

(iv) Conservation of Biodiversity

This tribal area is very rich in biodiversity – land races and indigenous genes in cultivated and medicinal plants. Efforts would be made to preserve biodiversity to enable tribals to utilise genetic material for their benefit.

(v) Production System

- Mixed farming – crop + livestock particularly small ruminants – goat, sheep, rearing, poultry, etc. for which the tribals have long traditions and local skills.
- Mixed cropping, coarse cereals, pulses, oilseeds adopted to ecological conditions.
- LEISA (Low External Input Sustainable Agriculture) with higher reliance on organic manures, IPM, INM.
- Cultivation of medicinal and herbal plants.

(vi) Alternate Livelihood System

Traditionally the tribals have been supplementing their food, nutrition and income by collection of medicinal plants and other minor forests produce, which will be promoted. The processing and marketing will be organised to save tribal from exploitation by middle men. Other cottage industries including basket making and other bamboo based decorative products would be supported. Sericulture, beekeeping and lac cultivation would be supported as tribals have skill and tradition for rearing useful insects.

(4) Cost Structure:

- Capacity Building and EPA @Rs.2000/- per ha.
- Conservation measures @ Rs.5000/- per ha (70% for water resources development and 30% for soil conservation).
- Production systems including cultivation of medicinal plants @Rs.4000/- per ha.
- Alternative livelihood system including processing and marketing of minor forest produce @ Rs.1000/- ha.

Total cost – 12000 x 5000 = Rs.60,00,0000/-= Rs.60 million.

5.2.1.4 NORTH WESTERN AND CENTRAL SUB HUMID REGIONS – SALINE & SODIC AND WATERLOGGED AREAS

In this sub-humid region there are three distinct degradation types.

5.2.1.4.1 WESTERN LOW RAIN FALL AREA WITH BRACKISH GROUND WATER, SOLUBLE SALTS AND WATERLOGGING.

This area around Rohtak in Haryana was dry farming region with pearl millet and pulse cultivation. Then a low water allowance of 1.5 cusec/1000 acre irrigation system was introduced. Cotton cultivation started as a cash crop. After linking with Bhakra Beas Canal, water allowance was increased to 3 cusec/1000 acre. Since this is a low rainfall and low slope valley land natural drainage lines are not developed. Ground water is brackish and soil profile is impregnated with soluble salts. With uncontrolled faulty irrigation practices brackish ground water started rising up. Cotton crop could not stand over saturation of water in the root zones and disappeared. Rice and wheat cropping systems followed this. This necessitated irrigation in both cropping season and more inflow of canal water. Thus stronger upsurge of ground water with high soluble salts. The end result is large areas are salinised and waterlogged. Not only crop cultivation is suffering but residential areas of villages and towns are becoming inhabitable.

India would endeavour to avail technology from countries like Netherlands and other such countries and financial assistance through UNCCD and other financial mechanisms. A pilot project of about 1000 hectare would be taken up. The provisional estimated of Rs.20 million @Rs.20,000/- per ha. is proposed. However, the details of the activities and the cost structure would be worked out with external experts through UNCCD.

5.1.4.1.2 NORTH WESTERN AND NORTH EASTWARDS SODIC SOIL SUB-HUMID REGION.

The degraded areas suffer due to poor irrigation practices in the Command Areas of Ganga Canal, Ramaganga Canal and Sharada Sahayak Canal systems. Ground water is sweet and sodification has taken place damaging physical conditions (soil structure) and chemical properties of the soil. Considerable areas have been rendered uncultivated. A World Bank funded Project in U.P. has created good model of community managed reclamation and sustainable use of degraded land resources. The treatment include compartmental bunding, application of soil amendments – gypsum and pyrite and puddling, horizontal drainage through community managed surface drains and vertical drainage through net work of tube wells. Rice-Wheat Rotation is practised. During summer month summer cultivation of vegetables and summer pulses with tubewell irrigation brings sub surface water on ground which is lost through evapo-transpiration, increasing the soil profile storage capacity. Since ground water is sweet, the rehabilitation system is working very well. The coverage is very small considering large areas suffering from sodification. Under UNCCD India would attempts to access additional external funding and technology refinement to reduce the cost so that entire

degraded lands could be treated. It is important because sodification is ingressing to adjoining lands, which are not affected so far. During short term period (2002-2007) a sum of Rs.100 millions is being proposed to achieve the rehabilitation of degraded lands and arrest the process of sodification of adjoining good lands.

5.2.1.4.3 DRAINAGE CONGESTION WATERLOGGED SUB HUMID REGION

There is considerable drainage congestion areas in the Himalayan foot hills and southward starting from Central U.P. to Eastern U.P. Due to drainage congestion there is water logging. This area can not be drained because of non-availability of outfall due to sand casting and silt deposits from Indian and Nepalese mid-Himalayas in the river beds. Waterlogging is great health hazards like Malaria in human beings and liver fluke and foot and mouth diseases in livestock. Mobility and transport are also adversely affected. The combined effect is shortage of food, malnutrition, health hazards and environmental degradation. After rainy season there is water scarcity. Earlier projects have already implemented a technology comprising desilting and construction of village ponds with fish culture, vertical drainage through a net work of shallow tube wells for summer cultivation, planting high transpiration ratio trees like *Eucalyptus*, *Termanalia* Species etc (biological pumps) degraded lands have been brought back to productive use and problem of water logging has been solved satisfactorily. Due to financial constraints there is slow progress in extension of the technology to other areas. India would seek supplementary funding to accelerate the process of reversing the land degradation. The technology is low cost and only an expenditure of Rs.7000/- per ha. is needed. During pilot phase it is proposed to extend the technology to 5000 hectares at the cost of Rs.35 millions.

5.1.5 REHABILITATION OF DEGRADED FORESTS – PARTICIPATORY AND REGENERATIVE FORESTRY

It is estimated that an area of 31 mha is degraded forest. The deforestation is taking place due to burgeoning biological pressure owing to increased peoples' needs of fodder, fuel and minor forest produce. There is an urgent need to rehabilitate such forest lands and to restore ecological balance and improve the livelihood of rural poor through participatory and regenerative forestry and silvipasture systems. First ground flora will be promoted through over seeding of grasses and legumes with minimum soil and water conservation measures. The social fencing would be ensured by the PRIs. This would produce fodder just in one year and meet the fodder need of the people by cut and carry system. Thereafter trees will be planted in mosaic and not in fixed spacing, in consonance with soil and moisture conditions.

The average cost would work out to about Rs.9000/- per hectare (70% for water resources development and 30% for soil conservation measures). The estimated cost during short pilot phase would be Rs.9000 × 3000 ha.= Rs.27 million during the first five years.

[Note: The cost structures in all the above areas is indicative and normative. Actual cost will be worked out after detailed ground survey and in consultation with the local communities]. It should be noted that the average cost does not mean that each and every hectare will need the same amount of money. In all the watershed and in all the degraded forest areas, there will be areas which will require much less funds for treatment than the average unit cost. Conversely, there may be areas that would require much more money than the average unit cost. Thus, some areas will need money @ Rs. 5000/hectare and some may require Rs. 11-12,000/hectare. The average unit cost will increase in every five-year Plan to accommodate the inflation, increase in wages and cost of material.]

5.2 LONG TERM PERSPECTIVE PLAN – STRATEGY AND ACTIVITIES

Long term Perspective Plan would be implemented in 2 phases:

5.2.1 Phase I - 2007 to 2022 – Co-terminus with national projections.

Phase I of Long Term Perspective Plan under UNCCD would be integrated with national perspective plan. Activities to be taken up would be similar to those mentioned in short term pilot strategy and programme for all the affected dryland regions in the country and types of land degradation. This would be the up scaling phase based on experience gained in the short-term pilot strategy and programme. The information and data base collected by the proposed **National Mission on Soil Survey and Land Degradation Mapping** would be utilised to select the most affected districts for rehabilitation efforts.

Funding requirement and external funding under UNCCD would be integrated with the Long Term Strategy and Perspective Plan. In view of rising cost due to inflation the funding has been linked with the national five-year plan projections for treatment of the degraded lands. The plan wise area proposed to be rehabilitated estimated average unit cost, total cost and cost-sharing pattern is indicated in the Annex.I.

5.2.2 Long Term Strategy Phase II – (2020- 2037): During this phase, the balance degraded lands and new areas that might be degraded would be taken up for treatment. The activities and cost structure would be worked out towards the end of Long Strategy Phase I on the basis of experiences gained and data generated. It would be too telescoping to work out details of this phase at this stage.

6. INSTITUTIONAL FRAME WORK: ORGANISATIONAL STRUCTURE

The Ministry of Environment & Forest is the nodal agency and the National Focal Point for participation in UNCCD as representative of Govt. of India. Ministry of Agriculture (142 million hectare) and Ministry of Forest (67 million ha.) are responsible for two major land uses in the country. In addition, the Ministry of Rural Development and the Ministry of Water Resources are also involved in land use and management. The Indian Meteorological Department (IMD) and the National Remote Sensing Agency (NRSA) are engaged in providing valuable information related to land degradation.

Several Autonomous Institutions including Indian Council of Agricultural Research, Indian Council of Forestry Research & Education, Indian Council Social Sciences Research, State Agricultural Universities are providing research and technology support.

For effective participation of India in UNCCD, effort would be made to utilise the existing institutions to the maximum possible extent. However, appropriate institutions would be supported and minimum new institutions/ or groups would be created. Some existing institutions would be broad based. The major institutions/ departments/divisions are in the area of land degradation survey and mapping, drought monitoring and early warning systems, drought preparedness and management and participatory research and participatory development. The organogram is illustrated in the flow-chart given in Fig.2.

6.1 NATIONAL POLICY AND COORDINATION COMMITTEE (NPCC)

NPCC under chairpersonship of Secretary, Ministry of Environment of Forests would have representatives from related Ministries, departments, state governments, academic institutions, NGOs etc. The committee

would lay down policies and promote co-ordinated involvement of all concerned institution/organisation on behalf of the govt. of India.

6.2 DESERTIFICATION CELL IN THE MOE&F

The Desertification Cell in the Ministry of Environment and Forests would comprise of a multi-disciplinary team including agriculture, forestry, environment science, geo-hydrology, rural development and social sciences. It would service NPCC on all matters like preparation of NAP, monitoring its implementation, organising reviews, feasibility studies and evaluation/impact studies. The secretariat would interact with national mission on mapping of soil and land degradation, drought monitoring and early warning group, drought preparedness and drought management including contingency planning group and participatory research and technology group. It will also interact and create enabling mechanism and environments at States and Divisional Commissioners' level.

Its major task would be to enable local communities like *Panchayat*, CBOs, SHGs to plan and implement the NAP at ground level.

6.3 NATIONAL MISSION ON SOIL SURVEY AND LAND DEGRADATION MAPPING

This Mission is very important to accurately map and delineate different forms of land degradation in the country including the forest area. The Mission would also involve Forest Survey of India, Survey of India and the District Collectorate where basic land records are maintained. The Mission also would establish a system for periodical assessment of dynamics of land degradation. The Mission will be provided financial support for starting and managing the survey, mapping and delineation.

6.4 DROUGHT MONITORING AND EARLY WARNING SYSTEMS IN MOA AND IMD

The existing Crop Weather Watch Group would be broad based and one Member of UNCCD Secretariat would participate in the meetings. Drought Monitoring and Early Warning Capacity of the Agro Meteorology Section in IMD would be appropriately strengthened.

6.5 DROUGHT PREPAREDNESS, DROUGHT MANAGEMENT AND CONTINGENCY PLANS

The natural disaster management division of MOA would be broad based and one Member of the UNCCD secretariat would participate in all the meetings related to drought preparedness, drought management and contingency plans. The representative of the drought monitoring and early warning system would also participate in the meetings of natural disaster management related to drought. Appropriate support would be provided for effective management and contingency planning and implementation.

6.6 PARTICIPATORY ON-FARM RESEARCH AND TECHNOLOGY GROUP

This group would be organised in the natural resource management division of the ICAR. Specific field problems identified by the village communities would be attended by the respective ICAR research institute/ agricultural university. Indigenous technical know-how and traditional system of rain water harvesting would be documented, appraised and promoted. Overall coordination would be done by ICAR/ICFRE Headquarters. One member of the secretariat would be actively involved in the implementation of field research. Financial assistance would be provided for on-farm trials surveys and studies.

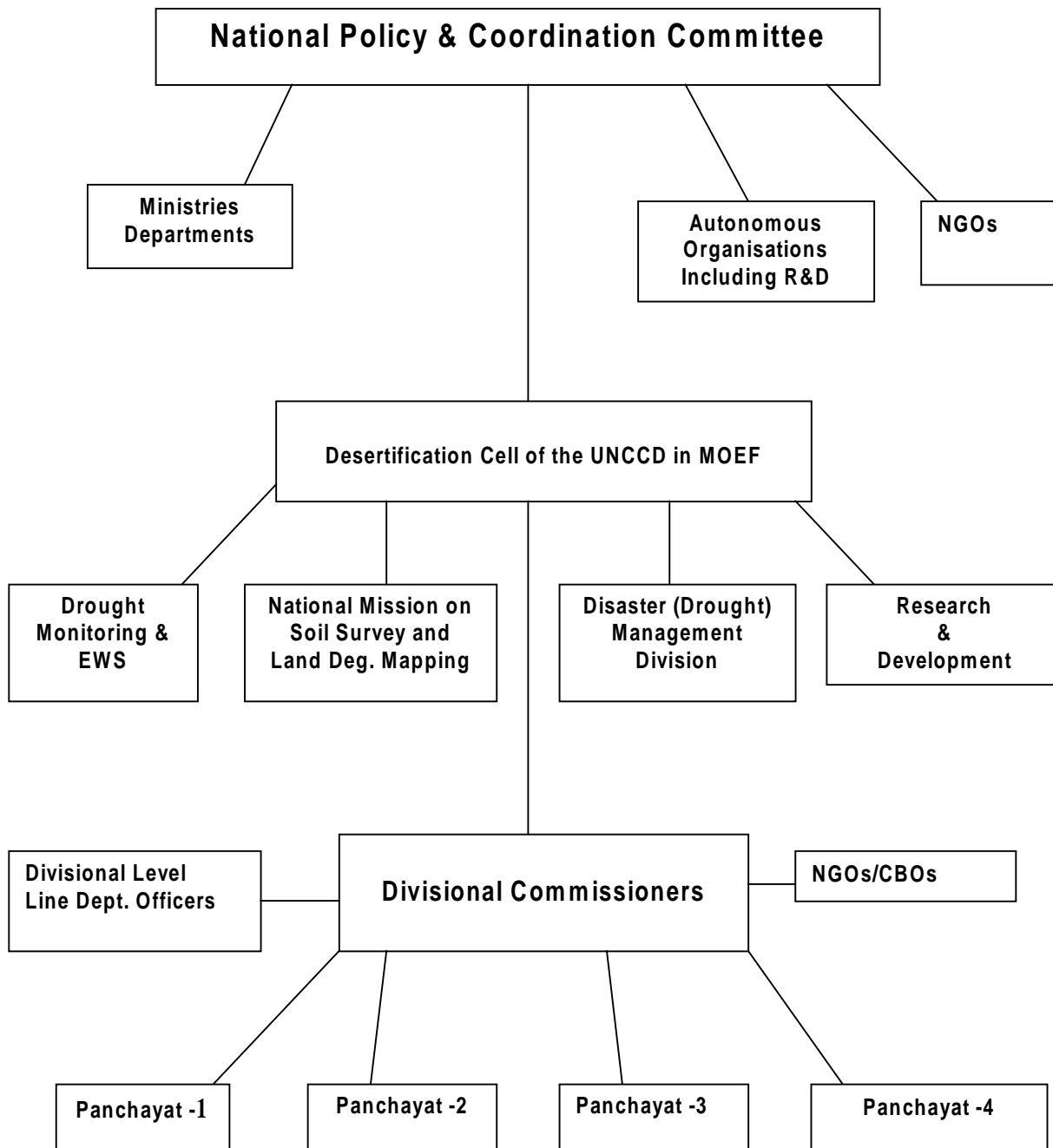


Fig. 2 Organogram Showing the institutional Framework

6.7 COORDINATION AND FACILITATION MECHANISM AT DIVISIONAL COMMISSIONERS' LEVEL

In each divisional commissioners' jurisdiction, a few districts will be taken up. In each district, a few *panchayats* will be selected. These *panchayats* would be organized into an apex body under the chairmanship of the Divisional Commissioner. This apex body would co-ordinate inter-district experience sharing and needed administrative support to the *panchayats*. NGOs will be involved at the *panchayat* level and also at the Commissioners' level. The line Department officers at the Commissionery level will also be members of this Committee.

6.8 PANCHAYATI RAJ INSTITUTIONS AND COMMUNITY BASED ORGANISATION FOR LOCAL AREA DEVELOPMENT PROJECTS (LADPS)

Such grass root level organisations and institutions would play major role in planning implementation, monitoring and evaluation of the field projects. Their capacity will be built on various aspects including technical, financial, group dynamics, leadership, book and record keeping through training exposure visits, print and electronic media etc. Thus the primary unit of *panchayat* would spearhead the sustainable management of land in a bottom-up mechanism.

7. MOBILISATION OF FINANCIAL RESOURCES

India accords very high priority to prevention and reversal of land degradation because most of the poor are living in arid, semi-arid and dry sub humid conditions. The nation also endeavours to make maximum financial provision. But considering the large area suffering from land degradation, coverage so far has been limited (in about 50 years only a total of 25 to 30 million hectares have been treated). There is a need for external financial support to accelerate the pace of rehabilitation of the degraded lands.

The principle of financial management would be based on participatory contribution and cost sharing.

- local communities, though poor, would contribute labour
- national and state governments
- international financial assistance – grants concessional loans etc. through UNCCD.

For implementing the activities and interventions in the short term and long term strategy, financial requirement along with cost sharing pattern are given in Annex.I and II.

8. CONCLUSION

India has 2.4% of the total land of the world, 16.7% of world population and 18.0% of the livestock population of the world. About 70% of its population depend on land based occupation like agriculture, animal husbandry and allied activities. Therefore land degradation has been receiving highest attention and its reversal high priority. The country faced quite a few natural calamities like devastating cyclones in coastal areas of Orissa and Andhra Pradesh, major earthquakes in Maharashtra and Gujarat and frequent droughts and floods in different parts of the country. The financial resources are perforce directed to the efforts for mitigating the effort of such natural calamities. Still financial provision for land and natural resource management has been increasing significantly during successive Five-Year Plans. This is eloquent testimony of India's priority and commitment to reclaim degraded lands. But the success has been limited for want of financial resources. Out of the vast areas in need of intensive treatment to reverse the process of land degradation only 25 to 30 million ha. have been rehabilitated so far. Therefore India as a Developing Country Party and Signatory to UNCCD is participating in the Convention with commitment and expectation.

India would endeavour to seek financial assistance through bilateral and multilateral channels. It is relevant to mention that many international funding agencies like World Bank, EU, UNDP, FAO and bilateral donor agencies like DFID, UK, Swiss Development Co-operation (SDC), Danish International Development Assistance (DANIDA) etc. are already providing financial assistance. Along with fund, valuable technology have also been provided by donor agencies: for example vegetative conservation measures through World Bank, important role of indigenous technology through SDC, strong poverty focus through DANIDA and use of flexible *gabions* in place of masonry structures from Indo-British Dry Land Farming Projects. India hopes to build upon these collaborations for accessing higher level of funding and improved technologies.

India has valuable ITK and important research findings from several research institutes dealing with different aspects of the land degradation. Valuable research funding have been documented. The country also has about 50 years' experience of development projects under different agro-climatic conditions. Important lessons have been learnt from successes and failures. India will be very happy to share its research findings and development experiences at sub regional, regional and international levels. The country will be willing to learn from experiences of other countries and benefit from them.

India has created enabling environment for the local communities to manage their land and natural resources through 73rd Constitutional Amendment, 1992. Grassroot level elected institutions have been empowered to manage *inter-alia* land resources. A number of national policies have been established to create enabling environment and policy frame work for promoting self help culture and dominant role of local communities in all aspects related to land degradation and its rehabilitation.

India is thus fully prepared to meet the obligation under UNCCD which provides a platform and motive force for the country to move faster for achieving the goal of sustainable development.

Thus, the National Action Programme is characterised by the following features:

- a) Water is a diacritical element for building people's confidence and satisfaction level, reclamation of degraded lands for sustainable biomass production ultimately leading to a better quality of life and enabling conditions through empowerment of the local communities.

- b) Bottom up approach and project planning, evaluation and monitoring by *Panchayat Raj* Institutions (Grass root level elected local self Governments in which women have at least 30% representation would be followed. Capacity of the PRIs and CBOs constituted by them, like self-help groups and user groups, etc., would be built up on all aspects of land development including rehabilitation of degraded areas, encompassing technical, financial group dynamics, equity, gender, etc.
- c) Convergence of resources and services. All resources available under different schemes will be channelled through *Panchayats*. Thus, a single window service will be available to the communities.
- d) Gaps in all the on-going schemes of different departments will be identified and resources will be provided to fill them up for generating good impact at the ground level.
- e) The first five-year period will be experimental and include pilot projects and activities.
- f) Concurrent and continuous monitoring will be done and mid-course correction will be effected as the experiences are gained.
- g) The problem faced by the farmers will be reported to R&D institutions for finding solutions. Thus both lab-to-land and land-to-lab flow of information will be ensured.

India is thus fully prepared to meet the obligation under UNCCD which provides a platform and motive force for the country to move faster for achieving the goal of sustainable development.

ACTIVITIES AND FUND REQUIREMENTS

A. SHORT TERM STRATEGY 2002-2007

S.No.	Activities	Financial Estimates Rs. in million	Cost Sharing (Rs. in Million)		
			Local Community	National /State Govts.	External Funding (Grant/ Concessional Loan)
1. Capacity Building					
1.1	Assessment and Mapping of land degradation – National Mapping Mission on Soil and Land Degradation.	750	Nil	375	375
1.2	Support to Desertification Cell in the MOEF	Ministry of Environment and Forests to work out			
1.3	Support to Drought Monitoring and Early Warning System Groups	MOEF and India Meteorological Department to work out the details.			
1.4	Support to Drought Preparedness and Contingency Plan (MOA)	MOEF and Ministry of Agriculture to work out details			
1.5	Support to ICAR/ICFRE and other R&D institutions for participating on Farm Research/PTD and Development of Indigenous Technologies	100	Nil	50	50
2.	2.1 Pilot watershed development project for combating desertification				
	<ul style="list-style-type: none"> • Local capacity building. • Land and water conservation, plantation and other production systems. • Alternate livelihood system. 				
2.1.1	Arid North West Dry Region (5000 ha)	55	8.25	19.25	27.5
2.1.2	Semi Arid – Central Deccan Plateau 5000 ha.	55	8.25	19.25	27.5
2.1.3	Semi-arid high slope High Rainfall rocky tribal plateau 5000 ha.	60	9	21	30
2.1.4	Saline, Sodic and waterlogged areas	20	3	7	10
2.1.4.1	North West Saline and waterlogged areas 1000 ha.	20	3	7	10
2.1.4.2	Sub-Humid North West and North Eastward Sodic Soil.	50	7.5	17.5	25
2.1.4.3	Sub-humid northern drainage congestion waterlogged areas 5000 ha.	35	5.25	12.25	17.5
2.1.5	Rehabilitation of degraded forest lands.	27	4.05	9.45	13.5
Total in Rs. (in million)		322	48.3	112.7	161
Total in US \$ (in million)		6.44	0.966	2.254	3.22

ACTIVITIES AND FUND REQUIREMENT

B. LONG TERM STRATEGY – PHASE I – 2007-2022

Plan Period	Area Proposed to rehabilitate (m.ha) (Approx)	Estimated cost (Rs./ha)	Total cost Rs. in millions	People share 15%	National Govt. (Centre + State) 35%	External Funding (Grants/ Concessional Loans) 50%
XI Plan (2007-12)	25	9000	225,000	30,000	70,000	100,000
XII Plan (2012-17)	30	10500	315,000	42,750	99,750	142,500
XIII Plan (2017-22)	35	12000	420,000	48750	113750	162500
Total (in Rs. millions)	90	-	960,000	121500	283500	405000
US\$ (in millions)			16200	2430	5670	8100

For the purpose of calculation; Conversion rate Rs.50 = US\$ 1